CO_2SMO PLUS!

RESPIRATORY PROFILE MONITOR

Service Manual

Model 8100

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Declaration of Conformity with European Union Directives

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Section 1 *Safety*

The *CO_2SMO Plus!* monitor is electrically isolated. Patient leakage current flowing from the instrument to ground is limited to less than 100 uA at 120/220 VAC, 50-60Hz.

For maximum patient and operator safety, you must follow the following warnings and cautions.

WARNINGS

Indicates a potentially harmful condition that can lead to personal injury.

- Explosion Hazard: *DO NOT* use *CO_2SMO Plus!* in the presence of flammable anesthetics. Use of this instrument in such an environment may present an explosion hazard.
- Electrical Shock Hazard: Always turn *CO_2SMO Plus!* off and remove the line cord before cleaning it. Refer servicing to qualified service personnel.
- Never sterilize or immerse the monitor in liquids.
- Do not operate *CO_2SMO Plus!* when it is wet due to spills or condensation.
- Do not operate *CO_2SMO Plus!* if it appears to have been dropped or damaged.
- Failure of Operation: If the monitor fails to respond as described, do not use it until the situation has been corrected by qualified personnel.
- The *CO_2SMO Plus!* is not intended to be used as a primary diagnostic apnea monitor and/or recording device.
- Patient Safety: Care should be exercised to assure continued peripheral perfusion distal to the SpO_2 sensor site after application.
- Inspect the SpO_2 sensor site often for adequate circulation - at least once every four hours. When applying sensors take note of patient's physiological condition. For example, burn patients may exhibit more sensitivity to heat and pressure and therefore additional consideration such as more frequent site checks may be appropriate.
- Data Validity: As with all pulse oximeters, inaccurate SpO_2 and Pulse Rate values may be caused by:
    - Incorrect application or use of sensor;
    - Significant levels of dysfunctional hemoglobin; carboxyhemoglobin or methemoglobin;
    - Significant levels of indocyanine green, methylene blue, or other intravascular dyes;
    - Exposure to excessive illumination such as surgical lamps-especially those with a xenon light source, or direct sunlight;
    - Excessive patient movement;
    - Venous pulsations;
    - Electrosurgical interference.
- A "NO RESPIRATION" alert is not generated when both the CAPNOSTAT CO_2 sensor and the CO_2/flow or flow sensor are disconnected from the *CO_2SMO Plus!*.
- The *CO_2SMO Plus!* automatically identifies the type of CO_2/flow sensor (neonatal, pediatric or pediatric/adult) or flow sensor (neonatal or pediatric/adult) when it is connected. If a flow sensor identification message is not displayed when a flow or CO_2/flow sensor is first connected, DO NOT use the sensor. If the condition persists, refer the monitor to qualified service personnel.

- Periodically check the CO_2/flow sensor and tubing for excessive moisture or secretion build up. Although the *CO_2SMO Plus!* automatically purges the lines, excessive moisture or secretions may still remain.
- While using the CO_2/flow sensor, a system leak, such as that caused by uncuffed endotracheal tubes or a damaged CO_2/flow sensor may significantly effect flow related readings. These include flow, volume, pressure, deadspace, CO_2 production and other respiratory mechanics parameters.
- Connect the line cord to a grounded hospital-grade outlet. *CO_2SMO Plus!* should be connected to the same electrical circuit as other equipment in use on the patient. Outlets of the same circuit can be identified by the hospital's engineering department.
- The *CO_2SMO Plus!* has no protection against the ingress of water.

CAUTIONS

Indicates a condition that may lead to equipment damage or malfunction.

- Do not operate *CO_2SMO Plus!* when it is wet due to spills or condensation.
- Do not operate *CO_2SMO Plus!* if it appears to have been dropped or damaged.
- Keep *CO_2SMO Plus!* and its accessories clean.
- Never sterilize or immerse the monitor in liquids.
- Do not sterilize or immerse sensors except as directed in this manual.
- Do not apply excessive tension to any sensor cable or pneumatic tubing.
- Do not store the monitor or sensors at temperatures less than 14°F (-10°C) or above 131°F (55°C).
- Do not operate the monitor or sensors at temperatures below 50°F (10°C) or above 104°F (40°C).
- Federal (U.S.A.) law restricts this device to sale, distribution, or use by or on the order of a licensed medical practitioner.
- DO NOT attach an SpO_2 sensor distal to a blood pressure cuff. Valid data CANNOT be processed when the cuff is inflated. Attach the sensor to the limb opposite to the site used for the blood pressure cuff.
- Excessive moisture in the CO_2/flow sensor may affect the accuracy of the flow measurement.
- To avoid the effects of excessive moisture in the measurement circuit, insert the CO_2/flow sensor in the ventilator circuit with the tubes upright (as shown by arrows). The striped tube is positioned closest to the patient. Improper placement will result in erroneous data.
- It is recommended that the CO_2/flow sensor be removed from the circuit whenever an aerosolized medication is delivered. This is due to the increased viscosity of the medications which may contaminate the sensor windows, causing the sensor to fail prematurely.
- In case of interference with our equipment or another manufacturer's equipment, notify your Novametrix representative.

NOTES

Indicates points of particular interest or emphasis for more efficient or convenient operation.

- Components of this product and its associated accessories which have patient contact are free of latex.
- As with all flow measuring devices, adverse conditions may affect the accuracy of the flow measurement.
- If CO_2 is being measured while not using a CO_2/flow sensor, certain rebreathing circuits, or the presence of artifacts such as cardiogenic oscillations, may cause *CO_2SMO Plus!* to react to non-respiratory CO_2 fluctuations as if they were breaths. This condition affects only the numerical displays; the capnogram display continues to provide an accurate picture of the CO_2 waveform.

- When a new CAPNOSTAT CO_2 sensor is attached to the monitor, or is moved from one monitor to another, it must be initialized before use. The CAPNOSTAT CO_2 sensor does not have to be initialized again as long as it is used with the same monitor.
- The Sample Pump will not turn on if a combined CO_2/flow or flow sensor is connected to the *CO_2SMO Plus!*. If the Sample Pump is already on and a combined CO_2/flow or flow sensor is connected, the Sample Pump will turn off.
- If you use the *CO_2SMO Plus!* for transport or if you drastically change the orientation of the *CO_2SMO Plus!*, the CO_2/flow sensor must be manually re-zeroed.
- After the life cycle of our equipment and all accessories has been met, disposal of the equipment should be accomplished following the national requirements. Contact the local Novametrix representative for questions concerning disposal.

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Section 2 *Introduction*

2.1 Indication for use

The *CO_2SMO Plus!* is intended to be used for monitoring end tidal CO_2, respiration rate, functional oxygen saturation, pulse rate and respiratory mechanics in monitoring environments such as ventilatory support, emergency and anesthesia. *CO_2SMO Plus!* is designed to monitor adult, pediatric and neonatal patients. *CO_2SMO Plus!* is not intended for any other purposes.

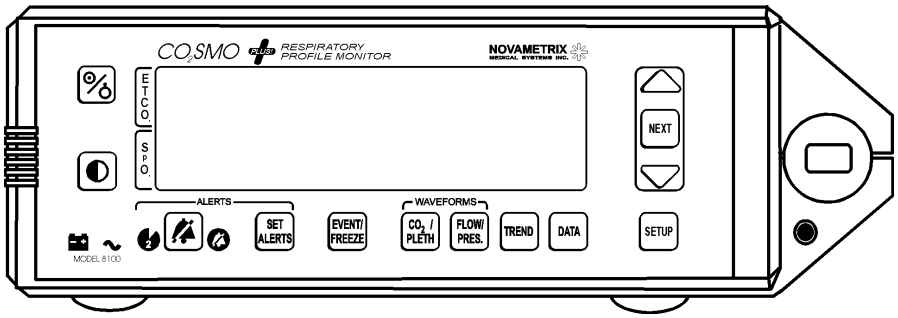
NOTE

Components of this product and its associated accessories which have patient contact are free of latex.

Gas compositions other than those selected in the SETUP screen can influence CO_2 and flow measurement.

2.2 Operational Overview

Front Panel Controls and Indicators



2.2.1 Controls

Power Key

Press the POWER key to place the unit into operate mode (ON) or to place the unit into standby (OFF). There are four states of the unit:

- No AC Power, power icon ∿ off, not in operate mode

  In this condition the AC switch is off, or the power cord is not plugged into an AC outlet, or the outlet is not powered. No monitoring may occur in this state. Battery is not being charged.

- AC Power, power icon ∿ on, not in operate mode (standby)[1]

  In this condition the unit may be placed into operate mode by pressing the [%] key. Battery is charging in this mode.

- AC Power, power icon ∿ on, in operate mode

  In this condition the unit is in operating mode and the battery is being charged.

- Battery power, power icon ∿ off, battery is not being charged

  In this condition the unit is in the operating mode and the battery is not being charged.

When the monitor powers up a self test is performed in which all indicators will temporarily illuminate and the monitor will emit a short beep. Following the self test the monitor will display:

"ERASE STORED TRENDS?
YES: △ NO: ▽"

If the △ or ▽ key is not pressed within five seconds, trends will be retained. The monitor is now ready for operation.

Contrast

Press or hold to adjust the display's contrast for different up/down viewing angles.

Alert Silence

Press for 2 minute silence (audible alerts muted for two minutes). The 2 icon will illuminate for the duration of the two minute silence. Press again to cancel.

Press and hold for 3 seconds to disable audible alerts, and the icon will flash. Press and hold again to cancel.

Press to acknowledge a latched alert.

If preconfigured not to allow the audio off function, the [🔕] key will not disable the audible alerts when pressed (the two minute silence is still active).

Set Alert Limits

Press to set alert limits manually, or hold to set automatically. Press again to accept the displayed limits and return to the previous screen.

Event/Freeze

Press the [EVENT/ FREEZE] key to freeze the waveforms and loops for sixty seconds. An EVENT MARKER with time and date will appear in the message center for three seconds followed by "WAVEFORM FROZEN

1. The monitor must be in "stand-by" mode in order for the CAPNOSTAT CO_2 sensor to remain heated when the monitor is off.

UNFREEZE: PRESS EVENT KEY". To resume normal display press EVENT/FREEZE again, otherwise the waveform will resume again in 60 seconds.

Pressing this key when viewing the DATA entry screen allows you to enter the patient's $PaCO_2$ for calculation of Vd/Vt phy, Vd phy and Vd alv.

CO_2 Waveform/Plethysmogram

Press to switch waveform display between capnogram and capnogram with plethysmogram.

Flow/Pressure Waveforms

Press to switch waveform display between flow and pressure waveforms, or flow and volume waveforms, or flow vs. volume and volume vs. pressure loops.

Trend

Press to switch between trend screens.

Data Screen

Press to switch between data screens (numeric values only), and data entry screen (to enter weight and $PaCO_2$).

Setup/Configuration

Press to display SETUP screen, or hold for three seconds to display CONFIGURATION screen (for advanced settings). Press again to accept the displayed settings and return to the previous screen.

Adjustment Keys

Press NEXT to select different parameters in SETUP, CONFIGURATION, SET ALERTS or DATA ENTRY screen. Press △ and ▽ to change value or state of the currently selected parameter.

The NEXT key is also used to:

- Select different time bases on the Trend screens
- Rescale various waveforms if scaling is set to manual.

The △ and ▽ keys are also used to respond to monitor prompts such as "ERASE STORED TRENDS? YES: △ NO: ▽."

From the FLOW/PAW screen, use the △▽ keys to adjust the spontaneous threshold line.

2.2.2 Indicators

Battery Alert Icon

Illuminates when the unit is on battery power and the battery charge is critically low. When battery is near exhaustion an audible alert will sound and “BATTERY VERY LOW PLUG IN AC POWER” will appear in the display screen. Refer to Battery Maintenance on page 65 for information on connecting AC power and charging the battery.

AC Power Indicator Icon

Illuminates when the monitor is connected to an AC power source and the rear panel power switch is ON “|”. In this condition the internal battery is charging.

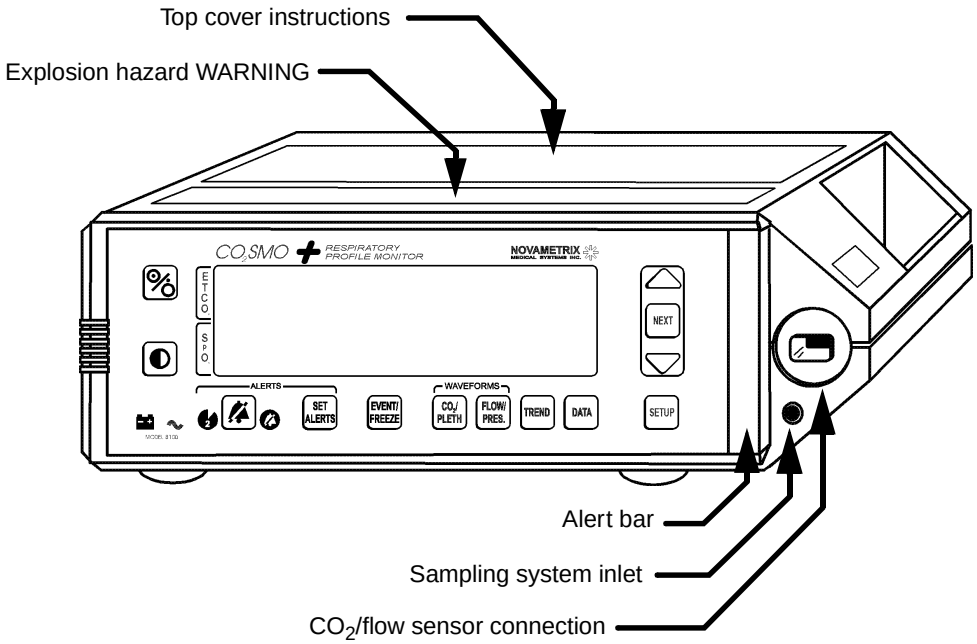
Two Minute Silence Icon

Illuminates when the two minute silence is active.

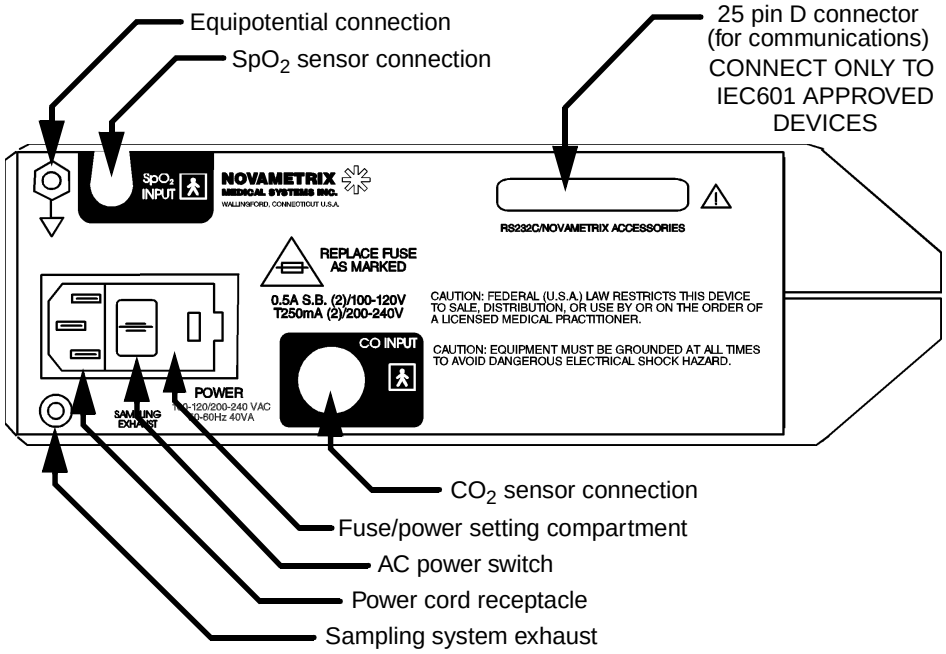
Audible Alert Disabled Icon

Flashes when audible alerts have been disabled.

2.2.3 Miscellaneous



2.3 Rear Panel Connections and Labeling



	Equipotential: Connection to monitor's chassis
	Patient isolation: Identifies connection as type BF
	Attention: Consult manual for detailed information
	Mains fuse rating for replacement fuses
	AC mains switch "|" ON-connection to mains; "O" OFF-disconnection from mains
	Recyclable item. This symbol is found on the internal battery and should not concern the common user. Refer to qualified service personnel when battery replacement is required.
	Separate collection. Appropriate steps must be taken to ensure that spent batteries are collected separately when disposed of. This symbol is found on the internal battery and should not concern the common user. Refer to qualified service personnel when battery replacement is required.
Pb	Indicates heavy metal content, specifically lead. This symbol is found on the internal battery and the monitor enclosure and should not concern the common user. Refer to qualified service personnel when battery replacement is required.

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Section 3 Theory of Operation

The *CO_2SMO Plus!* monitor measures the primary parameters of CO_2 production, blood oxygen saturation, pulse rate, respiration rate, airway pressure and flow. Other parameters are derivative of these primary properties. The system contains all the circuitry necessary for controlling, collecting, conditioning and displaying patient information gathered from the CAPNOSTAT®, Saturation and FloTrak® sensors. The *CO_2SMO Plus!* monitor's theory of operation is explained in detail in the subsections that follow.

3.1 2726 Power Supply Board

The 2726 Power Supply Board contains the circuitry needed to power the monitor from the AC Mains (line voltage). The power supply board also connects to the battery and contains the battery charging circuitry.

Model 8100 units shipped to Japan have an alternate power supply board assembly (2748-01) installed. These boards are identical to the 2726-01 board with the exception of the power transformer T301. The transformer in the Japanese board (2748-01) is rated for operation at slightly lower line voltage (down to 90 VAC). The operation and testing are identical and the manual text that applies to the 2726-01 board also applies to the 2748-01 board.

The schematic and assembly print for the 2748-01 board are included. The parts list for the 2748-01 is listed on the assembly print 2748-01-00.

3.1.1 AC Mains and Battery Operation Overview

The Model 8100 can be powered from its internal 12 volt battery or from the AC Mains. The green ∿ (sine wave shaped) front panel indicator illuminates when the line cord is connected and the rear panel power switch is in the "|" (On) position. This indicates that AC Mains power is reaching the power supply, that the battery is being charged, and that if the monitor is turned on, it is being powered from the line voltage.

If AC Mains power is removed by unplugging the line cord or setting the rear panel power switch to the "0" (Off) position, the monitor will operate for up to two hours from its internal 12 volt lead-acid battery. As the battery voltage runs low (≈11.5 volts), the red 🔋 (battery indicator) on the front panel illuminates. At this point, the AC Mains should be reconnected to power the monitor and charge the battery.

If the monitor continues to be powered from a battery in a low voltage situation, at approximately 11 volts, a continuous alarm sounds for thirty seconds while an alert message is displayed. If this alarm/message is ignored, the monitor displays will shut down and the battery indicator will flash on and off about every 5 seconds. If AC power is now restored, the monitor will re-initialize (go through the power up and self-test routines) and resume normal operation. However, continued battery operation will eventually activate a hardware low voltage circuit (≈10.0 volts) that shuts the monitor off to prevent damage to the battery. Once the unit is shut down with the hardware circuit, the AC Mains must be connected and the front panel power key pressed before the monitor will turn back on.

3.1.2 AC Mains Operation

The AC Mains voltage enters the monitor at the rear panel Power Entry Module (PEM). This device contains a built in RFI power line filter, a double-pole single-throw switch that opens and closes both AC input lines, fuses, and an input voltage selection card.

The filtered, switched and fused output of the Power Entry Module is fed to the primary coils of the rear panel mounted system transformer, T301, this is mounted on the 2726 Power Supply Board. The secondary output from T301 is fed to the Power Supply Board and is rectified by D1 (bridge rectifier) and filtered by C1. The (loaded) DC voltage at this point is approximately 20 volts.

The 20 VDC is fed to the 2731 Main Board through fuse F301 to connector P102, and is switched to the battery charging regulator IC1 (pin 5) through Q1. Biasing for Q1 is accomplished by D2, R1 and R2 when AC power is applied. When running on battery power Q1 is biased off by R1, R2 and D3, this prevents the battery from trying to power the battery charger regulator IC1. Power to IC2 is also removed, this informs the monitor of the loss of AC via the LINEST line.

The output of switching regulator IC1 pin4 is rectified and filtered by D4, C4 and L1 then fed to the battery through current sense resistor R3 and fuse F302 to J302 pin 1 (VBAT+). The battery float charge voltage is maintained at 13.2 volts except for fast charge which is regulated at 14.4 volts. The output is also monitored for over current conditions. These parameters are controlled by IC3 and associated circuitry. When the battery charge current exceeds 120mA of current IC3 pin 7 goes high which biases Q2 on, this in turn shorts out R12 which affects the feedback control (FB) to IC1 (pin 1). With R12 shorted out the control resistors R14 and R13 set the output voltage to 14.4 volts. When the charge current lowers IC3 pin 7 goes low which biases Q2 off, this puts R12 back into the feedback control which now consists of R12, R13 and R14 setting the voltage to 13.2 volts. When too much current flows through R3, IC3 pin 1 shorts IC1 pin 2 to ground which shuts IC1 off until its next switching cycle, when the current reaches a safe level IC3 pin 1 allows IC1 to remain on.

The voltage switched by Q1 is also fed to IC2 as VCH (Voltage Charge). The output of this 5 volt regulator provides the LINEST (Line Status) signal to the main board at E302 pin 3. With AC applied, LINEST is high. LINEST goes low when the AC is disconnected. The LINEST line is also routed to the power on/off circuitry.

3.1.3 Battery Operation

Without AC power there will be no secondary voltage rectified by D1. Power for the monitor will be supplied from the battery at J102 pins 1 (VBAT+) and 2 (VBAT-). The battery power will conduct through D3 and F301 to the 2731 Main Board. The arrangement of R1, R2 and D2 bias Q1 off in this condition which prevents power from reaching IC1, IC2 and IC3. The output of IC1 is also protected by D5 which is now reverse biased, the bridge D1 is also reverse biased and prevents T301 from discharging the battery. With no voltage at IC2 the LINEST will be low which indicates to the main board that there is no AC power, and the front panel ∿ LED will be off.

3.2 Digital Control System

For circuit diagrams of the digital section described below, refer to schematic 2731-03, sheet 1, of the schematic. Embedded control for the system is provided by IC1, a Motorola MC68332 integrated microcontroller. In addition to a full 32-bit Central Processing Unit (CPU), this device also contains circuitry for system clock generation, peripheral chip select generation, data control, interrupt generation, a sophisticated timing co-processor, synchronous and asynchronous serial communication. In general, functional signals are grouped together into ports, and each signal can be independently programmed by software to be its pre-defined port function or as discrete I/O. Additionally, the functionality for several ports (Port C, E and F) can be pre-defined by the state of the data bus on system power-up. A special "background mode" port allows the device to be controlled by an external source for system debugging and testing. Also integrated on-chip are several activity monitors, as well as a software watchdog to ensure proper device and system operation. Refer to Table 1.

Table 1. CPU / Digital Control System

Port	Defined Function	Functionality Control , Data Bus Control (Alt Functions: D pulled low)
TPU 16 Channels	Timing Signal Generation	Each channel independently user programmable as TPU function or as Discrete I/O
QSM 4 Synchronous Serial Chip Selects & one asynchronous serial channel	Serial Communications Port: QSPI: Queued Serial Peripheral Interface SCI: Serial Communications Interface	QSPI chip selects independently user programmable, can be used as Discrete I/O or decoded to create up to 16 chip selects. SCI transmit can be programmed as Discrete I/O
Background Mode	System debugging	Allows an appropriate external device to control the microprocessor and system
C	Chip Selects	D0: CSBOOT* Data Width, 8 or 16-bit D1: CS1*-CS3* or BR*,BG*,BGACK* D2: CS3*-CS5* or FC0-FC2 D3-D7: CS6*-CS10* or A19-A23
E	Bus Control	D8: Control Signals or Discrete I/O
F	MODCK and Interrupts	D9: MODCK & IRQ or Discrete I/O

The maximum operating frequency of the integrated processor is 20.97 MHz. The operating frequency is software selectable and generated by an internal VCO operating from Y2, a 32.768KHz watch crystal. The Timing Processor Unit (TPU) co-processor of the MC68332 provides timing generation derived from the system clock. This feature is utilized to control the precise timing required for the acquisition of the End Tidal Carbon Dioxide ($etCO_2$) and saturation (SpO_2) signals. The TPU is also used to generate the PWM (Pulse Width Modulation) control for the CAPNOSTAT case and detector heaters, as well as provide the frequency generation for the audio tones. See Tables 2 and 3.

Table 2. TPU Timing Generation for the etCO$_2$ subsystem

Signal	Name	Function / Timing
CO2AZ	Auto Zero	Clears the Sample/Hold circuitry prior to data acquisition. Active High, 90 us
CO2PWENB	Pulse Width Enable	Defines the active time for both phases of the bipolar source pulse, used for pulse width protection circuitry. Active High, 810 us
SRCDRV0	Source Drive 0	First source drive signal. Active High, 405 us
CS*/H	Current Sample/Hold	Enables circuitry for source current measurement. Sample is taken when SRCDRV0 is active. Low = Sample, 90 us, High = Hold
SRCDRV1	Source Drive 1	Second source drive signal delayed for 10 microseconds after SRCDRV0 ends. Active High, 395 us
SS*/H	Signal Sample/Hold	Enables circuitry for CO_2 and Reference channel data acquisition. Low = Sample, 90 us, High = Hold
CASEPWM	Case Heater PWM	PWM control for the case heater servo
DETPWM	Detector Heater PWM	PWM control for the detector heater servo
TOUT1, TOUT2, TOUT3	Tone Generation	Variable frequency outputs to generate system audio

Table 3. TPU Timing Generation for the SpO$_2$ subsystem

Signal	Name	Function / Timing
ASAMP*	Auto Zero	Clears the Sample/Hold circuitry prior to data acquisition. Active Low
RDLED*	Red Channel LED control pulse	Defines the active time for the Red LED
IRLED*	Infra-Red Channel LED control pulse	Defines the active time for the Infra-Red LED
RSAMP*	Red Channel Sample/Hold	Enables circuitry for the Red Channel signal measurement. Sample is taken when SRCDRV0 is active. Low = Sample, 90 us, High = Hold
ISAMP*	Infra-Red Channel Sample/Hold	Enables circuitry for the Infra-Red Channel signal measurement. Sample is taken when SRCDRV0 is active. Low = Sample, 90 us, High = Hold

Ferrite filters have been placed on the microprocessor signals with fast rise and fall times (including timing, clock, data and address lines) in order to help reduce and suppress the radiation of electromagnetic interference (L1-L14). In addition, good EMI/EMC design techniques have been incorporated in the component layout and printed circuit board manufacture.

Table 4 lists the chip select, control and discrete I/O functions for the *CO_2SMO Plus!* system module. On power-up, Ports E and F are programmed as discrete inputs by pulling down their controlling data lines, DB8 and DB9. After power-up, the software sets up each pin function individually and performs a series of self tests to check the integrity of the system. During this initialization period, the MPU holds the SYSUP line low which keeps the system in an idle state. The state of configuration inputs on Port E (TST*, CNFG0*, CNFG1* and JP0*) are read. These inputs allow the software to identify different operating states such as Test Mode, or different hardware configurations. After the initialization period is complete and all system functions have been set, the MPU brings SYSUP high, indicating that the system is ready for operation.

Table 4. Chip Select, Control and Discrete I/O

Pot	Pin Functions	System Signal Name	I/O	Comments
C				D0-D7 pulled high, Pins are Chip Select on power-up
	CSBOOT**	BOOTCS*	O	Program PROM Chip Select Word (16-bits) wide mode, D0 = HIGH
	CS0* / PC0 / BR*	UBRAMWR*	O	Upper Byte SRAM Write Enable Allows for byte (8-bit) or word writes
	CS1*/ PC1 / BG*	LBRAMWR*	O	Lower Byte SRAM Write Enable Allows for byte (8-bit) or word writes
	CS2* / PC2 / BGACK*	RAMRD*	O	SRAM Read Enable, Word
	CS3* / PC3 / FC0	ROMWR*	O	FLASH PROM Write Enable, Word
	CS4* / PC4 / FC1	IORW*	O	Control for external System and CO_2 input buffer and output latch
	CS5* / PC5 / FC2	ROMWREN	O	Port C Discrete Output, prevents unintentional writes to FLASH EPROM. This signal must be asserted before ROMWR* in order to overwrite the FLASH
	CS6* / PC6 / A19	UARTCS*	O	High Speed UART Chip Select
	CS7* / PC7 / A20	PROFILE*	O	Enables profiling data output latch
	CS8* / PC8 / A21	DISPCS*	O	Display Chip Select for LCD control
	CS9* / PC9 / A22	FLOWIO*	O	Control for external Flow sub-system input buffer and output latch
	CS10* / ECLK / A23	RTCCS*	O	Real Time Clock Chip Select
E				D8 pulled low, Discrete I/O on power-up
	DSACK0* / Port E0	TST*	I	Initiate System TEST if Low
	DSACK1* / Port E1	DS1*	I	Data and Size Acknowledge 1*
	AVC* / Port E2	CNFG0*	I	Configuration Switch 0
	RMC* / Port E3	CNFG1*	I	Configuration Switch 1
	DS* / Port E4	DS*	O	Data Strobe

Pot	Pin Functions	System Signal Name	I/O	Comments
	AS* / Port E5	AS*	O	Address Strobe
	SIZ0* / Port E6	JP0*	I	Configuration Switch 2, Hardware Jumper Mode Select 0
	SIZ1* / Port E7	JP1*	I	Hardware Jumper Mode Select 1
	R/W*	RD*	O	Data Read Strode
		WR*	O	Data Write Strobe
F				D9 pulled low, Discrete I/O on power-up
	MODCK / Port F0	LED	O	LED CPU Activity Indicator
	IRQ1* / Port F1	SYSUP	O	System Initialization Complete
	IRQ2* / Port F2	CASEOT	O	Case Heater Over Temperature Shut Down
	IRQ3* / Port F3	DETOT	O	Detector Heater Over Temperature Shut Down
	IRQ4* / Port F4	EXTDCIN	I	Indicates external AC Mains power operation
	IRQ5* / Port F5	UARTIRQ*	I	External UART Interrupt
	IRQ6* / Port F6	PWRDWN*	O	System power down enable
	IRQ7* / Port F7	NMI	I	Non-Maskable Interrupt

3.2.1 Background Mode Debugging

External system debugging is possible by connecting an appropriate device (emulator or debugger) to header J400 then momentarily bringing the BERR* on J400 low. This halts the bus activity and turns control of the system over to the external device. In this mode, internal MPU registers can be viewed and altered, special test features can be invoked, and system memory can be read and written to.

3.2.2 System Memory

A 16-bit wide data path is used for FLASH PROM and SRAM transfers to maximize system throughput. Program code storage is contained in two 2-Meg 5V FLASH or EPROM (IC3 and IC5) devices. The FLASH PROMs are protected from unintentional over-writes of the program code by transistor Q1 and the ROMWREN signal. The ROMWREN line must be high prior to writing new code into the FLASH devices. Volatile data storage is contained in two 1-Meg SRAM (IC4 and IC6). The SRAMs can also be backed-up to retain their contents by applying a 2.5 Volt level on VBACK when main power is removed from the system. During the battery back-up state, transistor Q2 keeps the CS1* control of the SRAMs in the inactive state. This forces the data bus to a high impedance state, isolating the SRAMs from the rest of the system. True non-volatile storage for system parameters is provided by a serial EEPROM (IC8).

3.2.3 Serial Communications UART

In addition to the on-chip asynchronous serial communications interface (SCI) channel contained in the MC68332, a single channel UART (Universal Asynchronous Receiver/Transmitter), IC2, is provided for buffered high speed data communication to an external computer. The serial connection to external, non-patient, contact devices is electrically isolated from the patient applied sections by optical data couplers

(IC68, IC71, IC73, IC74) and isolated power supply (see page 9 of schematic). This connector is located on the rear panel. The data Input/Output pins 15-22 of the UART are bi-directional and their direction is controlled by the RDN and WRN when CEN is held Low. The bus is put into tri-state condition when CEN is High. Crystal Y1 is required for driving the internal baud rate generator and other clocking circuitry in the chip. The A0-A2 lines select the UART's registers for read/write operations. The data signals URxD and UTxD are diode protected against over voltage by D1 and D2. Refer to schematic 2731-03, sheet 9 and Table 5 for the pinout and signals of serial interface connector J100.

Table 5: Serial Connector, 25-pin D-subminiature connector (located on rear panel)

Pin Number	Signal	Function
1	NC	
2	RC1IN	Internal MC68332 UART Receive, RS232 Signal Level
3	TR1OUT	Internal MC68332 UART Transmit, RS232 Signal Level
4	TR2OUT	External UART Transmit, RS232 Signal Level
5	V-	Non-Patient RS232 Level Minus Supply Out
6	RC2IN	External UART Receive, RS232 Signal Level
7	IGND	Non-Patient Signal Ground
8	NC	
9	NC	
10	NC	
11	NC	
12	NC	
13	NC	
14	IRAW	Unregulated Power Supply Output
15	NC	
16	NC	
17	NC	
18	NC	
19	ASTxD	Internal MC68332 UART Transmit, TTL Signal Level
20	V+	Non-Patient RS232 Level Positive Supply Out
21	NC	
22	NC	
23	NC	
24	NC	
25	IVDD	Non-Patient 5V Logic Supply Out

3.2.4 User Interface Control Circuitry

Refer to schematic 2731-03, sheet 2.

The user interface features a 64 row by 240 column Liquid Crystal Display (LCD) module with a cold cathode florescent backlight. Patient and system information is presented in both graphical and textual formats organized into several screen configurations. A 13-switch membrane keypanel is provided for operator entry of screen selection, data entry and user input. The membrane panel also contains several LEDs which represent various system conditions, such as input power status (AC or Battery) and alarm state. Control of the user interface is provided by the IORW* chip select signal together with the RD* and WR* signals from the microprocessor. IC13 and IC15 are input buffers which read in the present state of the membrane keys. Depressing a key causes the signal line to be pulled low in contrast to its normally high state. Also located on the input buffer IC13 are the CAPNOSTAT CO2XDISC, CO2ZERO* and CO2SPAN* signals, which inform the system that a CAPNOSTAT sensor is disconnected, if it is connected and currently on the Zero Cell, or if it is connected and currently on the Reference Cell. IC17 provides a latched output for controlling the membrane and Alert LEDs and the LCD backlight. When the BACKLITE signal is pulled high (IC17 pin 13), transistor Q5A turns on allowing maximum display brightness. Otherwise, the current through the display must also pass through fixed resistor R103, causing the display to dim. Contrast control for the LCD is provided by DAC IC78 and amplifier IC77B (schematic 2731-03, sheet 9). When the CPU detects the closure of the contrast membrane key, the CPU sends a digital ramp input to the DAC which causes the its output to change accordingly. Inverting amplifier IC77B controls the base current into transistor Q31, which changes the output of the display contrast voltage, VDISP.

(See page 7) To supplement the visual indicators associated with the membrane keypanel and display, an audio output signal is generated to provide an additional mode to convey information to the user. Up to three tone frequencies are generated by the TPU processor of the MC68332 (DTOUT1, DTOUT2, DTOUT3). These signals are fed into separate reference inputs of the 8-bit DAC IC53, providing a means for independently attenuating each signal under CPU control. From the DAC, the individual signals are summed together by IC79A and filtered by L33 and C220 (see page 9). Audio amplifier IC76 drives the system speaker to produce system audio.

3.2.5 Real Time Clock, Power on RESET Generation and Glue Logic

Time-keeping for date and time stamping of patient trend information is provided by IC16 (see schematic 2731-03, sheet 2). This device contains a built in crystal for precise time and date measurement. In the absence of digital power, the time keeping function is maintained by the battery backed-up supply, VBACK.

On power-up, the system is forced into a RESET state by IC9 (schematic 2731-03, sheet 1). This chip creates the master active low system reset signal SRST*. An inverter is used to generate the active high RESET signal.

Chip selection for the serial peripherals are provided by decoders IC10 and IC14 and by the inverter IC11 (schematic 2731-03, sheet 2). IC18 and IC20 are used to determine CPU utilization during system development, latching various status bits out on connector J404. Latch IC19 is used to control the saturation analog signal processing and to drive the optical reflectors on the auxiliary pressure connector J411. On schematic 2731-03, sheet 8, input buffer IC62 is used to input the decoded output from the flow and auxiliary reflectors, while latch IC66 is used to control the flow pneumatics and provide the drive signals for the flow optical reflectors.

3.3 CO_2 System Analog Subsections

3.3.1 CO_2 Pulser Source Drive

Refer to schematic 2731-03, sheet 3.

The source drive circuitry is designed to drive the source with a bipolar signal to prevent the migration of charges within the source that may result from unidirectional electrical fields. The resistance of the source is monitored constantly to ensure the integrity of the system by sampling the current through the source while it is active.

The signals for source drive are generated by the TPU co-processor in the MC68332, IC1. The SRCDRV0 and SRCDRV1 lines are used to control the bipolar signal that drives the source. The SRCDRV0 signal goes High as soon as the CO2AZ (Auto Zero) line goes Low and the CO2PWENB (Pulse Width Enable) line goes High. The duration of SRCDRV0 is 405 us (micro-seconds), and drives the source in the positive direction. The SRCDRV1 line drives the source with an opposite polarity signal when High. There is a 20 us delay from when the SRCDRV0 line goes Low and the SCRDRV1 line goes High. This delay is to prevent the possibility of both SRCDRV0 and SRCDRV1 being active at the same time, thus creating a low impedance path between the two supplies. SRCDRV1 steers current through the source in the opposite direction from SRCDRV0.

When SRCDRV0 and CO2INH (Inhibit) are High the output of MOSFET Driver IC23A pin 7 will go Low. This turns the P-Channel half of MOSFET Q6 on. At the same time the output of MOSFET Driver IC24B pin 6 will be High biasing on the N-Channel half of MOSFET Q7 on. With both Q6B P-Channel and Q7A N-Channel on current will flow from +VSRC through Q6B to the positive source terminal, then back from the source negative terminal through Q7A, through R118 to -VSRC. When SRCDRV0 returns Low both Q6B and Q7A are turned off and no current flows through the source. After the 20 us delay, SRCDRV1 will go High. The output of IC24A pin 8 will go High biasing the N-Channel section of MOSFET Q6 on. The output of IC23B pin 5 will go Low turning the P-Channel of Q7 on. Current will now flow from +VSRC through Q7B to the source negative terminal, back from the source positive terminal through Q6A and R118 to -VSRC. Current will cease to flow when SRCDRV1 goes Low. The bridge circuit of Q6 and Q7 in effect switches the polarity of the drive signal of the source between +VSRC and -VSRC. CO2PWENB also falls with the falling edge of SCRDRV1, signaling the end of source activity.

When current flows through the source, it will also flow through current sensing resistor R118, creating a differential voltage proportional to the source current:

$V_{SRC} = (V_{SR} / R_{SR}) * R_S * A_{V(DA)}$ where

V_{SRC} = voltage out of difference amplifier proportional to current through the source element = 24V +/- 0.625V

V_{SR} = differential voltage across the source element

R_{SR} = resistance of the source element

R_S= resistance of the current sensing resistor = 1 ohm

$A_{V(DA)}$ = difference amplifier gain = 5

V_{SRC} = [120 (Volts*Ohms) / R_{SR}]

The voltage signal out of difference amplifier IC25A is level shifted through C36 and fed to the sample and hold IC26A. A low level on the CS*/H (Current Sample and Hold) signal allows the source current signal to be sampled. On the rising edge of CS*/H, the present voltage level of the source current signal is held and appears at the input to the Analog to Digital Converter IC12 (on page 2) for processing by the MPU. When CO2AZ is High the input to the sample and hold of IC26A is grounded to discharge any residual charge that may be on C36.

In order to prevent the source from being driven until the system is up and ready there is protection circuitry that inhibits the source drive until enabled. During system power-up, the RESET line keeps Q8

on. This causes the CO2INH line to be brought Low, preventing source pulses by pulling down SRCDRV0 and SCRDRV1 through D5. Protection circuitry also guards against extended pulse width as well as shortened duty cycle. On the rising edge of CO2PWENB, the trip point of IC27B is exceeded, allowing C39 to charge through R122. If the SRCDRV signals do not turn the Source Pulser off within 200 us after the 810 us pulse period, the trip point for IC27A will be exceeded, pulling the CO2INH line low turning the Pulser off. After the CO2PWENB signal returns Low, capacitor C41 discharges through R123, keeping the output of comparator IC27B at the voltage acquired by C39. After approximately 10.4 ms, C41 will have discharged below the comparator trip point. The comparator output goes low, discharging C39 and the circuit is ready for the next source pulse cycle.

3.3.2 CAPNOSTAT Case and Detector Heater Control

Refer to schematic 2731-03, sheet 4.

The temperature of the system directly affects its ability to accurately measure CO_2 and therefore must be precisely maintained at a controlled value. Two separate heaters and control circuitry are used; one regulates the temperature of the detectors for the CO_2 Input and Reference channels; the other regulates the temperature of the transducer case (and loosely maintains the temperature of the airway adapter). While the purpose of the Detector heater is to keep the detectors' sensitivity to infrared radiation constant, the function of the Case heater is to keep condensation from forming on the airway windows by elevating the window temperature above the ambient airway temperature. Both heaters use an efficient Pulse-Width Modulation scheme designed to decrease power consumption, with the PWM timing generated by the TPU under microprocessor control. For the purpose of describing the regulation loop, the case heater circuitry will be considered. The detector and case heater circuitry are identical.

Inside the CAPNOSTAT, a sensing thermistor is thermally connected to the heater module. Initially, the CAPNOSTAT is at the ambient temperature and the resistance of the thermistor is large. A small current flows through the signal path CASETHERM and only a small voltage is developed across R139. The microprocessor programs the TPU to allow a maximum duty cycle of 30% to power the PWM heater circuitry. This causes the heater control MOSFET Q13A to be pulsed on and off with a duty cycle that is under direct control of the program software. As the heater warms up the case, the thermistor's resistance decreases, raising the voltage appearing at the input of the control loop. As described below, the MPU looks at this output voltage and decreases the duty cycle of the PWM control circuitry, gradually reducing the power output into the heater. When the desired temperature set point is reached, a balance is struck between the energy delivered into the system and the heat flow out of the system.

The case thermistor is sensed by amplifier IC29B pin 5. The difference between the signal at the non-inverting input and the reference appearing at the inverting terminal generates an error voltage proportional to the sensed temperature at the amplifier's output:

$$e_o\ (V) = [83.133V / (R_{th}+3.32K)] - 10.2V$$ where e_o = amplifier output voltage

R_{th} = resistance of the thermistor

= 4.36933K at 45°C

$$\text{Temp (°C)} = 4.1288\ ((C/V) * e_{o\ (T)}\ V + 41.7321°C$$

where e_o = amplifier output voltage at temperature T

This error voltage is low pass filtered by amplifier IC28A, sent to the ADC and processed by the CPU to regulate the output pulses from the TPU. The TPU PWM signal is buffered by MOSFET Driver IC31 and capacitively coupled to the gate of the heater drive MOSFET, Q13A. Capacitive coupling the signal prevents a system fault that would allow the PWM to be stuck at a level that would cause a high heater output. In the absence of a pulse, the gate drive will be pulled high, disabling the output to the heater. The pulsed voltage signal out of the MOSFET is filtered by D12, L15, C53 and C54 to produce a DC output level for the heater. Since the TPU generated PWM signal is based on the system clock, it is synchronized

with the generation of the source pulse timing. This minimizes the effect of any random disturbance caused by the heater circuit on the detection of the CO_2 Data and Reference signals.

The error voltage out of amplifier IC29B also appears at the temperature watchdog comparator IC30B. If the error voltage reaches approximately 56 degrees Celsius, the comparator trips, turning Q11 off. The gate of MOSFET Q10A is pulled high by R138, which turns it off and VHTR is prevented from reaching the Source of transistor Q13A. The temperature of the sensor is also monitored by the MPU which will disable the heater when a temperature of 50 degrees Celsius is exceeded. To shut off the heater, the MPU asserts the CASEOT signal, turning Q12 on which turns Q11 and Q10A off.

3.3.3 CO_2 Input Signal Path

Refer to schematic 2731-03, sheet 5.

The signals from the sensor CO2DATAIN (CO_2 Data) and CO2REFIN (CO_2 Reference Signal) have similar signal paths. The CO2DATAIN passes through a high pass filter with a gain of 3.8 consisting of C68, R173 and buffer amplifier IC34B. The signal is fed to a Butterworth low pass filter IC33A and associated components. This filter has a gain of 2 with a corner frequency of 1.5 KHz. The output from the low pass filter is fed to a 12-bit digital to analog converter IC78 (refer to schematic 2731-03, sheet 9). The signal, CO2DIN comes into the reference of the DAC, which acts as a programmable gain stage followed internally by an amplifier with a fixed gain of 2. Here under processor control the signal's gain is adjusted to an acceptable level for conversion. The gain setting is adjusted using the digitized signal out of IC12 (page 2) as part of the feedback loop. Similarly, CO2REFIN is conditioned by high pass filter IC34A with a gain of 1.75 and low pass filter IC33B with a gain of 2. The equivalent fixed gains for the two input signals are not equal in order to compensate for differences in the output signal levels of the infra-red detectors in the CAPNOSTAT.

The output from IC78 (page 9), CO2DOUT, is buffered by IC35B (page 5) and AC coupled through C270 to IC94B. The CO2DATA signal received from the CAPNOSTAT is AC coupled by C68 prior to the high pass filter to remove any DC bias. Prior to sampling the CO_2 signal, the CO2AZ (Auto Zero) pulse biases Q16 on causing any residual charge on C270 to discharge to ground. At the start of the source pulse, the CO2AZ pulse goes Low and the CO_2 signal from the sensor is attained, and appears at the input of the sample and hold amplifier, IC26B. Near the end of the source pulse, the SS*/H (Signal Sample and Hold) goes Low and the peak signal is acquired on the internal sample and hold capacitor. SS*/H returns high at the end of the cycle, and the CO_2 signal on the sample capacitor is held at the peak value. The signal then passes through a low pass filter of R191 and C80 before being converted by the ADC into digital data and analyzed by the processor. The signal CO2REF follows an identical zeroing and acquisition path.

3.3.4 CAPNOSTAT Interface

A twenty pin connector, J408, interfaces the CAPNOSTAT with the system electronics. Ferrite filters have been placed on all lines to suppress radiated EMI and reduce susceptibility from high frequency external sources of interference.

3.3.5 Sampling Pump (see page 5)

To enable the monitoring of non-intubated patients, a single tapered sampling port is provided below the Flow connector. Regulator IC36 adjusts the pump motor speed and the flow rate of air through the tubing system via VR1. Pump motor current is sensed by measuring the voltage developed across resistor R207 using amplifier IC37B which provides a gain of 125. This provides an output of 8mA per Volt $\{V_o = (I_{pump}*R) / Gain\}$ into the 12-bit ADC IC12 (page 2), or approximately 5 uA per bit resolution $\{Vref_{(ADC)} / (2^{12}*Gain)\}* \{8mA/V\}$. A two-pole 31 Hz filter composed of IC37A provides high frequency attenuation.

3.4 Saturation Analog Subsections

3.4.1 LED Power Generation and LED Drive

Refer to schematic 2731-03, sheet 6.

Adjustable voltage regulator IC38 is configured as a constant current supply for the Red and Infra-Red (IR) sensor LEDs. R210 limits the current to Vref/R {1.25V/26.7 ohms} or 50mA, while D31 sets the maximum output voltage at 7.5 Volts. Capacitors C90 and C119 provide a reservoir for providing the instantaneous current demanded when the LEDs are turned on. Transistor Q19 allows shutting down the power to the sensor LEDs by the microprocessor.

Refer to schematic 2731-03, sheet 9.

The SPO2VLED voltage is used by both channels' drive circuitry. The DAC output portion "C" from IC78 is programmed by the processor and is buffered by amplifier IC67B. This voltage appears at the output of IC67B pin 7 and is labelled as SPO2VLED.

Refer to schematic 2731-03, sheet 6.

Connector J102 couples the saturation sensor to the monitor. Each sensor LED is controlled by an amplifier configured as a constant current driver. IC39A and IC39B are non-inverting amplifiers. The voltage appearing at the positive terminal will also appear at the negative terminal, and across current programming resistors R222 and R231. This voltage creates a current through R222 of 225mA {0.74V/ 3.3 ohms} when the RDLED* signal is asserted and Red LED is turned on. The driver for the IR LED creates a constant current source of 111mA across R231 and is controlled by asserting the IRLED* signal. The two control signals operate at 33 Khz with a 10% duty cycle and are staggered so that one LED is active during the middle of the other LED's off period.

Each LED (one red and one infrared) in the sensor is driven separately. Since the circuitry is similar, only one channel will be discussed; the corresponding components for the other channel will appear in brackets.

When the REDLED* [IRLED*] line is low Q21 [Q22] will turn off, this allows the SPO2VLED voltage, divided by R212 [R223] and R215 [R226], to drive the non-inverting input of IC39A [IC39B]. When IC39A [IC39B] output is high, Q20 [Q35] will turn on, this pulls current through the sensor LED from the IC38 supply (fed to the sensor from J102 pin 6). When the REDLED* [IRLED*] line is high, the input of IC39A [IC39B] is brought to ground potential because Q21 [Q22] is biased on. This shuts Q20 [Q35] off resulting in no current flow through the LED.

3.4.2 Saturation Input Signal Path and Signal Conversion

Refer to schematic 2731-03, sheet 6.

Light from the sensor's Red or Infrared LED shines through the pulsating vascular bed (the patient's finger, toe, etc.), placed between the LEDs and the photodiode. Some of this light emerges from the tissue and impinges on the photodiode, causing the photodiode to conduct current. IC44A pins 2-3 are set up as a differential amplifier that converts this input current to a voltage at the amplifier output. The sensors are wired such that photodiode current produces a positive voltage at IC44A pin 1[1].

The voltage at IC44A pin 1 is presented to an analog switch IC43A. This switch is controlled at pin 1 by INSIG* (Input Signal), and will be closed (IC43A pins 2 and 3 connected) except if the monitor is in a Probe Off Patient condition or is undergoing its self-test at system power up. The switch IC43B, controlled from SIGND* (Signal Ground), will be open (no connection between IC43B pins 6 and 7) except as noted above for the switch at IC43A. As a result, the IC44A output voltage passes undisturbed to the high pass filter consisting of R239 and C108.

1. This is true for SuperBright™ sensors. If a non-SuperBright™ (Novametrix part number 86xx series) sensor is connected, IC44A pin 1 will go negative.

The ASAMP* signal is active low whenever either sensor LED is turned on. This causes Q23 to turn off and the signal at C108 passes through to IC44B. The ASAMP* line returns to a logic high when neither LED is being driven, causing Q23 to turn on. With Q23 conducting, any voltage at C108 is discharged to ground and the next pulse will charge C108 from a known level. If it were not for Q23, any charge remaining on C108 from the previous pulse, or from ambient light reaching the photodiode, would be added to the charge from a new pulse—creating measurement errors.

If the signal at IC44B is the product of the Red LED being turned on, then RDSAMP* will go low and close the switch at IC43D. This sends the signal to a sample and hold circuit consisting of R247 and C124 (that maintains the signal until next sample pulse arrives), a gain stage (IC42A), a filter/divider network (C120, R218 and R409), and finally, to the Red channel Analog-to-Digital Convertor (ADC) IC45.

If the signal at IC44B is the product of the Infrared LED being turned on, then IRSAMP* will go low and close the switch at IC43C. This sends the signal to a sample and hold circuit consisting of R236 and C111 (that maintains the signal until next sample pulse arrives), a gain stage (IC42B), a filter/divider network (C103, R214 and R408), and finally, to the Infrared channel Analog-to-Digital Convertor IC41.

On power up, the system performs a self-calibration cycle to establish the level of background circuit offset. Calibration is performed by coordinating the control signals SPO2CAL, SPO2SC1, ASAMP*, RSAMP*, ISAMP*, SIGND* and INSIG*. Once the system baseline has been acquired, the Red and Infra-Red ADCs, IC41 and IC45, adjust their output to compensate for any system offsets found.

The main timing signal generation for saturation signal acquisition is generated by the TPU. Auxiliary signals for calibration and signal acquisition (SPO2CAL, SPO2SC1, SIGND* and INSIG*) are generated by the MPU control of output latch IC19 (reference page 2 on schematic).

3.5 Flow System Analog Subsections

3.5.1 Flow Zeroing and Patient Line Back-flushing

Refer to schematic 2731-03, sheets 7 and 8.

The zero process begins when the CPU brings the VALVE1, VALVE2, VALVE3 and VALVE4 lines high, energizing valves V1, V2, V3 and V4. This disconnects the differential pressure transducer IC50/IC95 (via V1 and V2) and the absolute pressure transducer IC59/IC96 (via V2) from the patient airway, shunts the differential pressure sensor ports (V4) and opens all pressure transducer ports to atmosphere through V3. Note that there are two possible installations for IC50/IC95 and IC59/IC96, depending upon the model configuration.

The pressure transducers are “zeroed” by adjusting the amplified and conditioned pressure output signals into the 12-bit Analog to Digital Converter (ADC, IC46) so that each reading reads approximately mid-scale (2048 counts) using a successive approximation algorithm. With a reference voltage of 2.5 Volts, each count returned by the ADC is equal to 0.6103 mV. Centering the no flow (ambient) signal to the ADC's mid-scale allows the sensor to report both positive and negative airway pressures. IC53, an octal 8-bit Digital to Analog Converter (DAC) provides the adjustment under microprocessor control. The DAC maintains each adjustment voltage obtained during the zeroing process until a new zero cycle is initiated.

The patient airway pressure transducer is "zeroed" first by adjusting the AUXTRIM output of the DAC until the Airway Pressure signal into the ADC, IC46, reads mid-scale. The barometric (ambient) pressure as sensed by IC59/IC96 is recorded after the airway pressure zero is completed. Next the flow channels are zeroed. A non-inverting summing amplifier (IC52B) combines two of the DAC's outputs and a constant voltage from IC52A equal to the mid-scale of the ADC. The output voltage produced by the summer is fed into IC49, a monolithic instrumentation amplifier, which takes the differential output of the pressure transducer, IC50/IC95, and adds an offset equal to the reference voltage input. DAC outputs VOUTA and VOUTB serve to provide the flow channels with a fine and a course adjustment. VOUTB, the course adjustment, is altered until the X10 Flow gain channel input into the ADC, FLOW10, reads

mid-scale. VOUTA, whose ratio is 1/256 that of VOUTB, is then used to fine tune the system by bringing the x100 Flow gain channel, FLOW100, to mid-scale. Finally, the x1000 gain channel is adjusted if required by changing the value of DAC output VOUTA. Once the x1000 gain channel is set, a reading is taken from all four flow gain channels. The result from each channel is stored in SRAM and used as an offset in the flow calculations. Valves V1, V2, V3 and V4 are then de-energized, reconnecting the pressure transducers with the patient airway.

If patient line purging is set, the system turns on the pump by bringing the PURGE line high after the zero values are recorded. A slight pressure is allowed to build in the pump tubing line that will aid in flushing out the patient airway tubing. To purge patient line 1, the CPU brings the VALVE1 and VALVE4 signals high, energizing Valves V1 and V4. V1 connects the pump with the P1 patient line, flushing out the patient P1 line while V4 shunts across the differential pressure transducer, preventing a differential pressure from appearing across the transducer. During purging, the system is able to monitor the pressure that is present in the selected patient line by reading the AWPRESS signal. VALVE1 is brought low and V1 is then de-energized, once again isolating the pump from the patient airway and allowing a pressure head to build once more. The VALVE2 line is then brought high and valve V2 is then energized, flushing out the patient P2 line. After all lines have been flushed out, V1 and V3 are re-energized allowing any residual pressure to be vented to atmosphere. All valves are then de-energized and the PURGE signal is brought low, turning the pump off. The purging-process is complete and normal patient monitoring continues.

A hardware watchdog, consisting of IC32B and the surrounding circuitry, limits the maximum pump on time, preventing overpressure from building in the patient lines.

3.5.2 Flow Circuitry

Differential Pressure Transducer, IC50/IC95, is a silicon-based, piezoresistive bridge with four active elements. When pressure is applied between transducer ports P1 and P2, a differential output voltage proportional to the applied pressure is produced. The full-scale output range for the transducer is 0 to 10 inches of water (P1>P2). By setting the 0 differential pressure (no-flow) point to mid-scale (during the zeroing process described earlier), negative pressure readings (P2>P1) are also available. The transducer is temperature compensated at 25 degrees Celsius and designed to be driven by a constant voltage source (IC54A, B).

In the normal system operating mode, all valves are de-energized and the pump is inactive. Transducer ports P1 and P2 are connected to the patient airway. As air flows through the flow sensor, a pressure difference between P1 and P2 is created. This signal is dependent on both the magnitude and the direction on the airflow. The greater the flow volume, the larger the pressure difference created between the two transducer ports. The transducer senses an inspired flow as a positive pressure difference (P1>P2), while an expiratory flow is seen as a negative pressure (P2>P1). With a source voltage of 5.0V, the sensor transforms this pressure difference into an electrical signal with a nominal absolute magnitude of 16.67 mV Full-scale Output. This signal is conditioned and amplified by IC49, which is a monolithic Instrumentation Amplifier (IA). The flow IA IC49 also offsets the signal to the mid-range of the ADC obtained during the zeroing process. A positive pressure difference (inspiratory flow) creates a signal above the offset (approximately 1.25 to 2.5V). A negative pressure difference (expiratory flow) becomes a 1.25 to 0V signal. The nominal gain of IC49 is set by fixed resistor R260 and variable resistor VR2. The output for the transducer is adjusted using VR2 and a known pressure input as a calibration reference. With an input differential pressure of 10 inH_2O, the gain of the amplifier is set to give an ADC count of 3498.

The signal out of the flow IC49 is taken through a two-pole low pass filter IC47B with a 31Hz cutoff frequency to remove unwanted high frequency electronic noise before it is passed on to the four gain stages (IC48 and IC51). The four flow differential gain amplifiers provide signal gains of 1 (Flow 1), 10 (Flow 10), 100 (Flow 100) and 1000 (Flow 1000). The gain of 1 amplifier is used to buffer the flow signal and provide signal conditioning consistent with the other channels. The x10, x100 and x1000 channels amplify the flow signal according to the following equation:

V_{out} $= (V_{flow}\text{-Vrefo}/2)(A_v) + (\text{Vrefo}/2)$

where A_v is the amplifier gain, R_{fb}/R_v (1, 10, 100 or 1000)

R_{fb} is the feedback resistor (R258, R269, R274)

R_v is the reference resistor (R257, R268, R273)

The circuit is designed to amplify the difference between the flow signal into each gain stage and the reference voltage so the zero point of each stage remains at mid-scale.

The output from each gain stage appears at the 12-bit analog to digital converter IC46, where it is transformed from an analog voltage into a digital code for processing by the CPU, IC1.

3.5.3 Barometric and Airway Pressure

IC59/IC96 is a piezoresistive differential pressure transducer with port P2 held at zero psi. It measures the absolute pressure difference at port P1 relative to the vacuum at port P2. The transducer is calibrated for a full scale output of 0 to 15 psi, has internal temperature compensation and is designed to be driven by a constant current source. An on-board calibration resistor is trimmed by the manufacturer and is used to set the current through the sensing bridge by amplifier IC57B. Instrumentation amplifier (IA) IC58 conditions this signal to correspond to the current barometric pressure, which is set by adjusting VR4. The nominal gain of this amplifier is 93.56, which corresponds to an ADC count of 3800 at 760 mmHg. The output signal from IC58 is low pass filtered by IC57A and appears as an input to both the 12-bit ADC and a second IA, IC56. IC56 provides gain adjustment via VR3 and offsets the output signal from the barometric amplifier to mid-scale during the zeroing state. This is handled by the VOUTC line from IC53, the output is then fed to the low pass filter circuit of IC55A. The nominal gain of the airway pressure amplifier is 5. This signal connects to the P1 (proximal to the patient) side of the differential pressure transducer during monitoring and provides patient airway pressure sensing (AWPRESS).

3.5.4 Patient Airway Adapter Type Sensing

Given a specific flow sensor type (i.e., Adult), the physical characteristics of the sensor will be consistent from one adapter to another. However, due to the differences in the physical size and geometry of the various flow sensor types (i.e., Adult, Neonatal), each type requires different coefficients be used in the calculation of flow. Each flow sensor type has a unique 3-bit code associated with it. This pattern molded into the connector body can be optically reflective or non-reflective and is read by the system. A pulse is generated by the CPU that turns on the LED component of a opto-coupler mounted directly beneath each pattern segment. If the pattern segment associated with that opto-coupler is reflective, the LED's light will cause its photodetector mate to be turned on, which generates a signal that is sensed by the system and relayed back to the CPU. If the segment is non-reflective, no signal is returned to the sensing circuitry. A three-bit code can generate 8 unique pattern combinations. One code condition, all zeros (no reflection), is reserved for detecting when the sensor unplugged. The circuitry to decode the flow sensor type is located on schematic 2731-03, sheet 8, and consists chiefly of connector J410, comparator IC60, Schmitt trigger IC61 and input buffer IC62. A separate connector (J411) and circuitry are provided to decode an auxiliary pressure port, which is currently not implemented.

3.5.5 Power Supply and Voltage Reference Generation

Refer to schematic 2731-03, sheets 9 and 10.

The monitor operates either on isolated AC Mains power or on the internal 12 Volt Lead-Acid Battery. A separate power supply board provides the AC rectification and filtering, battery charging and DC Input Voltage, VDCIN, for the Main 2731 PCB on J414. The heart of the power supply design for the system is a 100 KHz switching regulator, IC86, which utilizes a flyback transformer configuration to generate the DC supply voltages and provide the required isolation between the primary, secondary and isolated power planes. The primary of the transformer is designed to accept 10 to 24 V DC input and provides secondary outputs of nominally 5VDC, +13.5VDC, and -13.5VDC. An additional winding pair is isolated (2KV rating) from the other transformer windings to provides 9VDC output for the earth connected serial output circuitry. The 5VDC supply (VDD) provides feedback to the switching regulator

by resistor divider R379/R385. The other windings are loosely regulated to the 5VDC supply by the ratio of the transformer windings, creating unregulated secondary voltages for the analog supplies of approximately +\-13VDC. The 5V supply is L-C filtered to provide clean logic supplies for the analog sections of the CO_2 and Saturation (CVDD) and Flow (FVDD) sub-systems. Another filter isolates the 5 Volt supply for the Flow valves from the rest of the system. Analog supplies of +/-12VDC (+12V, +AVCC, -12v, -AVCC) are created by regulators IC85 and IC90.

These supplies are also filtered to provide a degree of power isolation between the Flow sub-system and the remainder of the system. IC87 and IC89 are designed as a tracking regulator pair to provide a 24VDC differential voltage for powering the CAPNOSTAT source (+VSRC, -VSRC). Linear regulator IC82 provides the logic and analog supply for the patient-isolated circuits. Power for the CAPNOSTAT Heaters, Display Backlight and Pumps are designed to run off of the battery for maximum efficiency. Linear regulator (IC91) provides the supply when the unit is plugged into MAINS power, since the DC input voltage can be 24VDC under high line conditions (refer to Table 6).

Table 6: Power Supply and Reference Outputs

Signal	Supply	
VDCIN	+10 - +24VDC	Main DC input generated from external MAINS or internal battery
VBATT	+10 - +12.5VDC	Internal Battery DC input
VBACK	+2.5VDC or +5VDC	Supply for SRAMs, either VDD or 2.5V to maintain SRAM data during power down
VHTR	+12V or VBATT	Supply for the CAPNOSTAT Case and Detector heaters, regulated at 12V when MAINS power available or from VBATT when unit is on battery power
VBKLITE	+12V or VBATT	Supply for the LCD Display Backlight and Pumps, regulated at 12V when MAINS power available or from VBATT when unit is on battery power
VDD	+5VDC	Regulated digital logic supply
VVDD	+5VDC	Regulated and filtered supply for the valves
CVDD	+5VDC	Regulated and filtered logic supply for CO_2 and Saturation analog sub-systems
FVDD	+5VDC	Regulated and filtered logic supply for the Flow analog sub-system
+VA	+13.5VDC (nominal)	Loosely regulated off of the 5VDC feedback line
+12V	+12VDC	Linearly Regulated and filtered positive analog supply for the CO_2 and Saturation sub-systems
+AVCC	+12VDC	Linearly Regulated and filtered positive analog supply for the Flow sub-system
+VSRC	+12VDC	Linearly Regulated and filtered positive supply for the CAPNOSTAT Source. Tracks -VSRC to provide a 24V +/- 2.5% differential voltage across the source
-VSRC	-12VDC	Linearly Regulated and filtered negative supply for the CAPNOSTAT Source. Tracked by +VSRC to provide a 24V +/- 2.5% differential voltage across the source
-AVCC	-12VDC	Linearly Regulated and filtered negative analog supply for the Flow sub-system
-12V	-12VDC	Linearly Regulated and filtered negative analog supply for the CO_2 and Saturation sub-systems
-VA	-13.5VDC (nominal)	Loosely regulated off of the 5VDC feedback line
IRAW	+7.5VDC (nominal)	Loosely regulated off of the 5VDC feedback line, isolated from the other transformer windings
IVDD	+5VDC	Linearly Regulated to provide an isolated digital and analog power source

Stable reference voltages for the sensors and analog circuitry are derived from IC70, a precision 2.5V with low drift. Five (5) and 2.5 Volt references for the CO_2 and Saturation circuits are generated by IC72, while a separate 5, 2.5 and 1.25 Volts are generated directly from IC70 and from IC75.

When the monitor is operated from an AC Mains power source, the green AC ON ∿ indicator on the front panel is lit. Pressing the Power ⏻ or ⏻ key on the front membrane keypanel will not turn the monitor off. Instead, the monitor is placed in a standby operating mode. The display, backlight and other non-essential control functions are inactivated by the software, giving the monitor the appearance of power down. While in standby however, the core system continues to operate, keeping the CAPNOSTAT heaters within temperature regulation. This reduces the time required to bring the system up to full operating specifications during the following power-up cycle.

If AC power is lost or is not available, the monitor automatically operates from its internal battery without interruption. The AC ON ∿ indicator is extinguished and a BATTERY ICON 🔋 appears on the display, indicating the current power level of the battery. While on internal DC power, the current state of the battery is monitored by both software and hardware (IC80B and IC88B, schematic 2731-03, sheet 10). Should the battery power level become low, the monitor software alerts the user. If the monitor is not placed on AC Mains power, the software will turn the unit off. Should the software fail to turn the monitor off, the hardware cutoff (IC88B) activates, turning the unit off. While on battery operation, depressing the Power ⏻ key on the front keypanel will turn the monitor off; stand-by mode is disabled and power to the system is turned off.

3.6 Digital Logic List

The tables below lists the signals in the Model 8100, including a brief description. Information not explicitly covered in the previous sections may be found here.

GROUP	SIGNAL	SYSTEM FUNCTION	SYSTEM SIGNAL	I/O	SIGNAL FUNCTION
SIM/EBI/Chip Selects	CSBOOT	CSBOOT	BOOTCS*	O	flash rom chip select
	BR/CS0*	CS0*	UBRAMWR*	O	upper byte sram write
	BG/CS1*	CS1*	LBRAMWE*	O	lower byte sram write
	BGACK/CS2*	CS2*	RAMRD*	O	sram read
	PC0/FC0/CS3*	CS3*	ROMWR*	O	flash rom write
	PC1/FC1/CS4*	CS4*	IORW*	O	input buffer read / output latch write
	PC2/FC2/CS5*	PC5	ROMWREN	O	flash rom write enable, uart autovector
	PC3/A19/CS6*	CS6*	UARTCS*	O	parallel uart chip select
	PC4/A20/CS7*	CS7*	PROFILE*	O	16-bit profile output latch
	PC5/A21/CS8*	CS8*	DISPCS*	O	lcd display chip select
	PC6/A22/CS9*	CS9*	FLOWIO*	O	flow input/output enable
	A23/CS10*	CS10*	RTCCS*	O	real time clock chip select
SIM/EBI/Bus Control	R/W*	R/W*	R/W*	O	read/write control
	RESET*	RESET*	RESET*	I/O	system reset
	HALT*	HALT*	HALT*	O	system halt
	BERR*	BERR*	BERR*	I	bus error

GROUP	SIGNAL	SYSTEM FUNCTION	SYSTEM SIGNAL	I/O	SIGNAL FUNCTION
SIM/EBI/ Port E	PE0/DSACK0*	DSACK0*	TST*	I	enables system test function
	PE1/DSACK1*	DSACK1*	DS1*	I	data and size acknowledge 1
	PE2/AVEC*	PE2	CNFG0*	I	configuration switch #1
	PF3/RMC*	PE3	CNFG1*	I	configuration switch #2
	PF4/DS*	DS*	DS*	O	68K data strobe
	PF5/AS*	AS*	AS*	O	68k address strobe
	PF6/SIZ0	PE6	CNFG3*/JP0*	I	config switch #3, hardwire jumper 1
	PF7/SIZ1	PE7	JP1*	I	hardwire configuration jumper 2
SIM/EBI/ Port F	PF0/MODCLK	PF0/MODCLK	LED	O	mpu activity led
	PF1/IRQ1*	PF1	SYSUP	O	system initialization complete
	PF2/IRQ2*	PF2	CASEOT	O	case heater over temp shut down
	PF3/IRQ3*	PF3	DETOT	O	detector over temp shut down
	PF4/IRQ4*	PF4	EXTDCIN	I	external ac input active
	PF5/IRQ5*	IRQ5*	UARTIRQ*	I	uart interrupt input
	PF6/IRQ6*	PF6	PWRDWN*	O	power down signal
	PF7/IRQ7*	IRQ7*	NMI*	I	non maskable interrupt
TPU	T2CLK	T2CLK		I	external TPU clock source
	TP0		CO2AZ	O	etCO2 autozero
	TP1		CO2PWENB	O	etCO2 source pulse width enable
	TP2		SRCDRV0	O	etCO2 source drive phase 0
	TP3		CS/H*	O	etCO2 current sample and hold control
	TP4		SRCDRV1	O	etCO2 source drive phase 1
	TP5		SS*/H	O	etCO2 signal sample and hold control
	TP6		CASEPWM	O	etCO2 case heater pwm
	TP7		DETPWM	O	etCO2 detector heater pwm
	TP8		ASAMP*	O	SpO2 auto zero sample
	TP9		RSAMP*	O	SpO2 red channel sample
	TP10		RDLED*	O	SpO2 red led control
	TP11		ISAMP*	O	SpO2 infra-red channel sample
	TP12		IRLED*	O	SpO2 infra-red led control
	TP13		TOUT1	O	tone output channel 1
	TP14		TOUT2	O	tone output channel 2
	TP15		TOUT3	O	tone output channel 3

GROUP	SIGNAL	SYSTEM FUNCTION	SYSTEM SIGNAL	I/O	SIGNAL FUNCTION
QSM/QSPI	MISO		SSDI	I	qspi master mode serial input
	MOSI		SSDO	O	qspi master mode serial output
	SCLK		SCLK	O	qspi master mode serial clock
	PCS0/SS*		PCS0	O	serial chip select 0
	PCS1		PCS1	O	serial chip select 1
	PCS2		PCS2	O	serial chip select 2
	PCS3		PCS3	O	serial chip select 3
QSM/SCI	TxD		ASTxD	O	sci transmit data
	RxD		ASRxD	I	sci receive data
TEST	IPIPE*/DSO	IPIPE*	IPIPE*	O	instruction pipe
	IFETCH*/DSI	IFETCH*	IFETCH*	O	instruction fetch
	BKPT*/DSCLK	BKPT*	BKPT*	I	hardware breakpoint
	FREEZE/QUOT	FREEZE	FREEZE	O	freeze, initiate background mode
	TSTME*/TSC	TSTME*	TSTME*	I	test mode enable
CLK	XTAL	XTAL	XTAL	I	crystal oscillator
	EXTAL	EXTAL	EXTAL	I	crystal oscillator
	CLKOUT	CLKOUT	SYSCLK	O	system clock
	XFC	XFC	XFC	I	external filter capacitor
	VDDSYN	VDDSYN	VDDSYN	I	power supply to vco
12-bit ADC #1		0	CO2DATA	I	etCO2 data channel
		1	CO2REF	I	etCO2 reference channel
		2	CO2ISRC	I	etCO2 source current
		3	CO2CASE	I	etCO2 case heater temp
		4	CO2DET	I	etCO2 detector heater temp
		5	SPO2FEDC	I	SpO2 front end dc
		6	SPO2RDLED	I	SpO2 red led power
		7	SPO2IRLED	I	SpO2 infra-red power
		8	ABPRESS	I	barometric pressure
		9	VSUMP	I	sampling pump motor current
		10	VBATTADC	I	battery voltage

GROUP	SIGNAL	SYSTEM FUNCTION	SYSTEM SIGNAL	I/O	SIGNAL FUNCTION
12-bit ADC #2		0	FLOW1	I	flow x1 gain channel
		1	FLOW10	I	flow x10 gain channel
		2	FLOW100	I	flow x100 gain channel
		3	FLOW1000	I	flow x1000 gain channel
		4	AWPRESS	I	airway pressure
		5	SPO2PROB	I	SpO2 probe signal
		6		I	
		7		I	
		8		I	
		9		I	
		10		I	
12-bit Quad DAC #1		0	CO2DOUT	O	etCO2 data gain adjust
		1	CO2ROUT	O	etCO2 reference gain adjust
		2	SPO2VLED	O	SpO2 led control voltage
		3	VDISP	O	display contrast control voltage
8-bit Octal DAC #2		0	FLOWFINE	O	flow offset fine adjust
		1	FLOWCRSE	O	flow offset coarse adjust
		2	AWTRIM	O	airway pressure trim adjust
		3	AUXTRIM	O	auxiliary pressure trim adjust
		4	TOUT1	O	tone output channel 1
		5	TOUT2	O	tone output channel 2
		6	TOUT3	O	tone output channel 3
		7		O	
CONFIGURATION SWITCH FUNCTIONS	S1 PIN	1	TST*	O	enables system TEST function
		2	CNFG0*	O	configuration switch #1
		3	CNFG1*	O	configuration switch #2
		4	CNFG2*/JP0*	O	config switch #3, hardwire jumper 1

GROUP	SIGNAL	SYSTEM FUNCTION	SYSTEM SIGNAL	I/O	SIGNAL FUNCTION
System Input Buffer	IORW* & RD*	D0	CO2XDISC	I	etCO2 CAPNOSTAT disconnected
		D1	CO2ZERO*	I	etCO2 zero switch
		D2	CO2SPAN*	I	etCO2 span switch
		D3	S13 (ADJUP)	I	keypanel switch 13, adjust setting up
		D4	S11 (ADJDWN)	I	keypanel switch 11, adjust setting down
		D5	S12 (NEXTITEM)	I	keypanel switch 12, next item select
		D6	S1 (POWER)	I	keypanel switch 1, power toggle
		D7	S2 (CONTRAST)	I	keypanel switch 2, display contrast
		D8	S3 (AUDIOSW)	I	keypanel switch 3, audio switch
		D9	S4 (ALERTSW)	I	keypanel switch 4, alert reset switch
		D10	S5 (EVNTFRZ)	I	keypanel switch 5, event / freeze key
		D11	S6 (CO2PLETH)	I	keypanel switch 6, co2 / pleth screen
		D12	S7 (FLOWPRES)	I	keypanel switch 7, flow / pressure scrn
		D13	S8 (TREND)	I	keypanel switch 8, trend screen
		D14	S9 (DATA)	I	keypanel switch 9, data screen
		D15	S10 (SETUP)	I	keypanel switch 10, setup screen
System Output Latch	IORW* & WR*	D0	2MINLED	O	2 minute procedure led
		D1	AOFFLED	O	audio off led
		D2	SPARELED	O	spare led control
		D3	BATTLED	O	battery on led
		D4		O	
		D5	ALERTS	O	alerts "kojak" leds
		D6	BACKLITE	O	display backlight dim
		D7	SAMPLE	O	co2 sampling pump control
		D8	SPO2CAL	O	SpO2 adc calibrate
		D9	SPO2SC1	O	SpO2 adc calibration mode
		D10	SPO2LPON	O	SpO2 led power on
		D11	INSIG*	O	SpO2 input signal enable
		D12	SIGND*	O	SpO2 signal ground control
		D13	OCDRV3	O	flow aux optical encoder drive 3
		D14	OCDRV4	O	flow aux optical encoder drive 4
		D15	OCDRV5	O	flow aux optical encoder drive 5

GROUP	SIGNAL	SYSTEM FUNCTION	SYSTEM SIGNAL	I/O	SIGNAL FUNCTION
Profile Output Latch	PROFILE*	D0	PROBIT0	O	profiling bit 0
		D1	PROBIT1	O	profiling bit 1
		D2	PROBIT2	O	profiling bit 2
		D3	PROBIT3	O	profiling bit 3
		D4	PROBIT4	O	profiling bit 4
		D5	PROBIT5	O	profiling bit 5
		D6	PROBIT6	O	profiling bit 6
		D7	PROBIT7	O	profiling bit 7
		D8	PROBIT8	O	profiling bit 8
		D9	PROBIT9	O	profiling bit 9
		D10	PROBIT10	O	profiling bit 10
		D11	PROBIT11	O	profiling bit 11
		D12	PROBIT12	O	profiling bit 12
		D13	PROBIT13	O	profiling bit 13
		D14	PROBIT14	O	profiling bit 14
		D15	PROBIT15	O	profiling bit 15
Flow Input Buffer	FLOWIO* & RD*	D0		I	flow optical encoder read bit 0
		D1		I	flow optical encoder read bit 1
		D2		I	flow optical encoder read bit 2
		D3		I	flow optical encoder read bit 3
		D4		I	flow optical encoder read bit 4
		D5		I	flow optical encoder read bit 5
		D6		I	
		D7		I	
Flow Output Latch	FLOWIO* & WR*	D0		O	valve 1 control
		D1		O	valve 2 control
		D2		O	valve 3 control
		D3		O	valve 4 control
		D4		O	purge pump control
		D5		O	flow aux optical encoder drive 0
		D6		O	flow aux optical encoder drive 1
		D7		O	flow aux optical encoder drive 2

GROUP	SIGNAL	SYSTEM FUNCTION	SYSTEM SIGNAL	I/O	SIGNAL FUNCTION
QSPI Decoder	PCS3*-PCS0*	0000	ns	O	no select
		0001	ADCCS1*	O	co2 & spo2 adc #1 chip select
		0010	DACCS1*	O	co2 & spo2 dac #1 chip select
		0011	CALEECS	O	calibrator eeprom chip select
		0100	OBEECS	O	on board eeprom chip select
		0101	SPO2RDADC*	O	spo2 red 20-bit adc chip select
		0110	SPO2IRADC*	O	spo2 infra-red 20-bit adc chip select
		0111	DACLD1*	O	co2 & spo2 dac #1 load enable
		1000	ns	O	no select
		1001	ADCCS2*	O	flow adc #2 chip select
		1010	DACLD2	O	flow dac #2 load enable
		1011	nc	O	no connect
		1100	nc	O	no connect
		1101	nc	O	no connect
		1110	nc	O	no connect
		1111	nc	O	no connect

CONNECTOR	DESIGNATOR	PIN	SYSTEM SIGNAL	I/O	SIGNAL FUNCTION
Background Mode Connector	J400	1	DS*	O	sram read
		2	BERR*	I	hardware breakpoint
		3	DGND		digital ground
		4	BKPT*	O	hardware breakpoint
		5	DGND		digital ground
		6	FREEZE	O	freeze, initiate background mode
		7	SRST*	I	system reset
		8	IFETCH*	O	instruction fetch
		9	MVDD		mpu power plane
		10	IPIPE*	O	instruction pipe
Boot Block Device Select	J401	1	RAMRD*	O	sram read
		2	SRAMOE*	I	sram output enable
		3	BOOTCS*	I	program rom chip select
		4	ROMOE*	O	rom output enable

CONNECTOR	DESIGNATOR	PIN	SYSTEM SIGNAL	I/O	SIGNAL FUNCTION
AUX Serial TTL	J402	1	UMPI	I	ttl level uart multi purpose input
		2	RxDIN1	I	ttl level serial receive
		3	TxDOUT1	O	ttl level serial transmit
		4	VDD		+5V supply output
		5	DGND		digital ground return
Keypanel Connector	J403	1	DGND		digital return path
		2	S8	I	membrane keypanel switch 8
		3	S2	I	membrane keypanel switch 2
		4	S11	I	membrane keypanel switch 11
		5	S3	I	membrane keypanel switch 3
		6	S9	I	membrane keypanel switch 9
		7	S4	I	membrane keypanel switch 4
		8	2MINLED	O	2 min procedure led
		9	S5	I	membrane keypanel switch 5
		10	AOFFLED	O	alert off led
		11	S6	I	membrane keypanel switch 6
		12	ALRTLED	O	alert led
		13	S7	I	membrane keypanel switch 7
		14	BATTLED	O	internal battery power led
		15	S1	I	membrane keypanel switch 1
		16	EXTONLED	O	external ac power on led
		17	DGND		digital return path
		18	S12	I	membrane keypanel switch 12
		19	S13	I	membrane keypanel switch 13
		20	S10	I	membrane keypanel switch 10

CONNECTOR	DESIGNATOR	PIN	SYSTEM SIGNAL	I/O	SIGNAL FUNCTION
Profiling Connector	J404	1	PROBIT0	O	profiling bit 0
		2	PROBIT1	O	profiling bit 1
		3	PROBIT2	O	profiling bit 2
		4	PROBIT3	O	profiling bit 3
		5	PROBIT4	O	profiling bit 4
		6	PROBIT5	O	profiling bit 5
		7	PROBIT6	O	profiling bit 6
		8	PROBIT7	O	profiling bit 7
		9	PROBIT8	O	profiling bit 8
		10	PROBIT9	O	profiling bit 9
		11	PROBIT10	O	profiling bit 10
		12	PROBIT11	O	profiling bit 11
		13	PROBIT12	O	profiling bit 12
		14	PROBIT13	O	profiling bit 13
		15	PROBIT14	O	profiling bit 14
		16	PROBIT15	O	profiling bit 15
Alert Connector	J405	1	VDD	I	digital power supply rail
		2	ALERTS	I	alerts led bar
Flow Decoder	J410	1	VVDD		+5V, flow valve supply rail
		2	VVDD		+5V, flow valve supply rail
		3	OCDRV0	O	optical decoder control 0
		4	OCDOUT0	I	optical decoder output 0
		5	OCDRV1	O	optical decoder control 1
		6	OCDOUT1	I	optical decoder output 1
		7	OCDRV2	O	optical decoder control 2
		8	OCDOUT2	I	optical decoder output 2
		9	VGND		return path for valve supply
		10	VGND		return path for valve supply
Sampling Pump Connector	J409	1	PUMP+		buffered data line 9
		2	PUMP-		buffered data line 10

CONNECTOR	DESIGNATOR	PIN	SYSTEM SIGNAL	I/O	SIGNAL FUNCTION
Display Connector	J406	1	DGND		digital return path
		2	DGND		digital return path
		3	VDD		digital power supply rail
		4	VDISP		display contrast control
		5	WR*	I	i/o write
		6	RD*	I	i/o read
		7	DISPCS*	I	display chip select
		8	A1	I	address line a1
		9	NC		no connect
		10	SRST*	I	system reset
		11	D8	I/O	data line lsb, 8-bit port
		12	D9	I/O	data line
		13	D10	I/O	data line
		14	D11	I/O	data line
		15	D12	I/O	data line
		16	D13	I/O	data line
		17	D14	I/O	data line
		18	D15	I/O	data line msb, 8-bit port
		19	VDD		digital power supply rail
		20	NC		digital return path
Backlight Connector	J407	1	VO1		dc-ac inverter output 1
		2	NC		no connect
		3	NC		no connect
		4	VO2		dc-ac inverter output 2
Speaker Connector	J413	1	VOUT1		speaker +
		2	VOUT2		speaker -
Power Input Connector	J414	1	VDCIN		dc input voltage
		2	VBATT		internal battery input
		3	LINEST	I	ac line state input
		4	GND		power return path

CONNECTOR	DESIGNATOR	PIN	SYSTEM SIGNAL	I/O	SIGNAL FUNCTION
CAPNOSTAT Connector	J408	1	CO2REFIN	I	co2 reference chnl detector output
		2	CO2DATAIN	I	co2 data channel detector output
		3	-12V		-12V, analog positive supply rail
		4	AGND		analog return path
		5	CASETHERM	I	case heater thermistor
		6	+12V		+12V, analog positive supply rail
		7	CVDD		+5V, co2 power supply rail
		8	DETTHERM	I	detector heater thermistor
		9	SSCLK	O	qspi master mode serial clock
		10	CALEECS	O	calibrator eeprom chip select
		11	SSDO	O	qspi master mode serial output
		12	SSDI	I	qspi master mode serial input
		13	ZEROSW*	I	zero cell switch
		14	SPANSW*	I	span cell switch
		15	DETHTR	O	detector heater power
		16	HTR RTN		return path for heaters
		17	SRCSHIELD		CAPNOSTAT outer shield
		18	CASEHTR	O	case heater power
		19	CO2SRC+	O	source pulser phase +
		20	CO2SRC-	O	source pulser phase -
AUX Pressure Decoder	J411	1	VVDD		+5V, flow valve supply rail
		2	VVDD		+5V, flow valve supply rail
		3	OCDRV3	O	optical decoder control 3
		4	OCDOUT3	I	optical decoder output 3
		5	OCDRV4	O	optical decoder control 4
		6	OCDOUT4	I	optical decoder output 4
		7	OCDRV5	O	optical decoder control 5
		8	OCDOUT5	I	optical decoder output 5
		9	VGND		return path for valve supply
		10	VGND		return path for valve supply
Purge Pump	J412	1	VPUMP		+12V pump supply rail
		2	NC		no connect
		3	PUMP-		purge pump supply return

CONNECTOR	DESIGNATOR	PIN	SYSTEM SIGNAL	I/O	SIGNAL FUNCTION
Serial Output Connector	J100	1	NC		no connect
		2	RxDIN1	I	serial receive, channel 1 (QSM)
		3	TxDOUT1	O	serial transmit, channel 1 (QSM)
		4	TxDOUT2	O	serial transmit, channel 2 (UART)
		5	BUFFV-		buffered voltage, neg RS232 level
		6	RxDIN2	I	serial receive, channel 2 (UART)
		7	IGND		patient isolated ground return
		8	NC		no connect
		9	NC		no connect
		10	NC		no connect
		11	NC		no connect
		12	NC		no connect
		13	NC		no connect
		14	IRAW		raw switcher voltage, fused
		15	NC		no connect
		16	NC		no connect
		17	NC		no connect
		18	NC		no connect
		19	TTLTxD1	O	ttl level serial transmit chnl 1 (QSM)
		20	BUFFV+		buffered voltage, pos RS232 level
		21	NC		no connect
		22	NC		no connect
		23	NC		no connect
		24	NC		no connect
		25	IVDD		+5V supply output, fused
SpO_2 Sensor Connector	J102	1	IRLED	I	IR led current control
		2	RDLED	I	red led current control
		3	DET+	I	photodetector +
		4	DET-	I	photodetector -
		5	AGND		analog ground return
		6	LEDPWR		led supply voltage
		7	NC		no connect

Section 4 *Functional Tests*

The Functional Test described below verifies overall functional integrity of the monitor and sensors. If the monitor or sensors do not pass these tests, remove from use and contact the Novametrix Service Department for repair/replacement assistance.

4.1 Equipment Required

1. CAPNOSTAT CO_2 Sensor, Catalog No. 7167-00
2. Adult airway adapter, Catalog No. 7007-01
3. SpO_2 Finger Sensor, Catalog No. 8776-00
4. Adult Flow Sensor, Catalog No. 6717-01
5. 1 Liter (1000 ml) Calibration Syringe, Catalog No. 550020
6. Model 1298 Gas Calibrator, Catalog No. 6081-00
   Low point calibration gas, Catalog No. 8364
   This device is used for gas flow control in checking the CAPNOSTAT CO_2 sensor and monitor. Use only Novametrix supplied Calibration Gas with this device.

4.2 Functional Testing

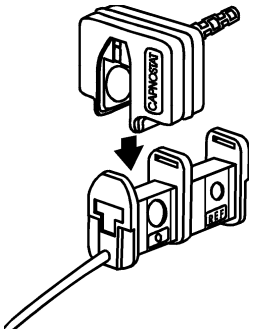
4.2.1 Start up

1. Visually inspect the monitor and verify there is no external damage.
2. Verify proper fuses and voltage setting on the rear panel. See “Mains Voltage Configuration” on page 63.
3. Attach the line cord and set the rear panel power switch to “|”.
4. Verify the green ∿ AC ON on the front panel illuminates. Press the % or 1/0 (power) key.
5. When the monitor powers up, a self test is performed in which all indicators will temporarily illuminate and the monitor will emit two short beeps. Following the self test the monitor will display:

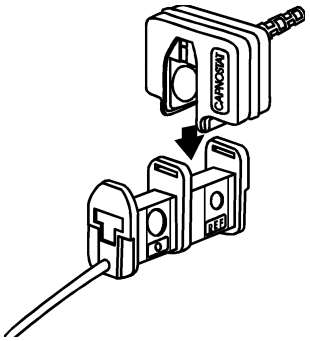
   “ERASE STORED TRENDS?
   YES: △ NO: ▽”

   If the △ or ▽ key is not pressed within five seconds, trends will be retained. The monitor is now ready for operation.

6. Press the CO2/PLETH key and verify both CO_2 and SpO_2 waveform screens are displayed.
7. Connect a CAPNOSTAT CO_2 sensor to the *CO_2SMO Plus!*.
8. Verify a "CO_2 WARM UP" message is displayed in the $ETCO_2$ window.
9. Verify the "CO_2 WARM UP" message clears and a "PUT ON -0- CELL" message.
10. Place the CAPNOSTAT CO_2 sensor on the Zero cell. Verify a "PLEASE WAIT FOR SENSOR" message.

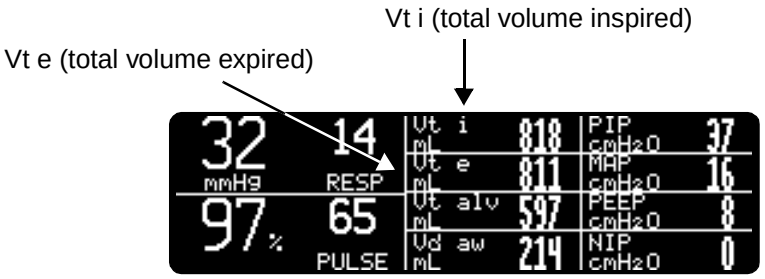


11. Verify the *CO_2SMO Plus!* zero calibrates.
    The monitor will display a 10 second clock in the $ETCO_2$ window and count down.
12. Verify a "PUT CO_2 SENSOR ON REFERENCE CELL" message is displayed.
13. Place the CAPNOSTAT CO_2 sensor on the Reference cell.



14. Verify a "CHECKING ON CELL" message is displayed.
15. Verify a "SENSOR PASSED" message and 38 ± 2 mmHg are displayed.
16. Place the CAPNOSTAT on an adult airway adapter.
17. Press the SETUP key.
18. Press the NEXT key until the selection arrow ▷ is beside CO_2 ZERO NOW.
19. Press the △ key.
20. Verify the *CO_2SMO Plus!* screen changes back to the main screen with a calibration message in the $ETCO_2$ display area.
21. Press the △ key again to start an airway calibration.
22. Verify the *CO_2SMO Plus!* zero calibrates.
    The monitor will display a 10 second clock in the $ETCO_2$ display and count down.
23. Connect the low point calibration gas to the Model 1298 Gas Calibrator. Refer to the instructions supplied with the gas calibrator for further instructions.

24. Connect the Model 1298 Gas Calibrator with low point calibration gas to the adult airway adapter.
25. Press and hold the SETUP key for five seconds.
26. Verify the CONFIGURATION screen comes up.
27. Press the NEXT key to select CO_2 AVG.
28. Press the △ key to select “INST”.
29. Press the CO2/PLETH key. Verify the *CO_2SMO Plus!* returns to the main screen.
30. Flow the calibration gas from the Model 1298.
31. Verify an $ETCO_2$ reading of 38 mmHg ± 2 mmHg.
32. Turn the calibration gas off.
33. Connect a Saturation Finger sensor to the *CO_2SMO Plus!*.
34. Connect the finger sensor to any of your fingers.
35. Press the CO_2/PLETH waveform key until the PLETH waveform is displayed.
36. Verify the *CO_2SMO Plus!* is displaying a saturation and pulse value.
37. Take the finger sensor off your finger.
38. Verify a “PROBE OFF” message is displayed in the SPO_2 window.
39. Connect a 6717-01 Adult Flow Sensor to the *CO_2SMO Plus!*.
40. Connect the flow sensor to the 1000 ml calibration syringe.
41. Press the DATA key until the TOTAL VOLUME screen is displayed.



42. Pump the syringe back at a rate of 15 cycles per minute.
43. Verify a Vt i and Vt e of 1000 ml ± 50 ml.
44. Press the CO_2/PLETH waveform key. Verify the *CO_2SMO Plus!* returns to the main screen.
45. Press and hold the ◐ key and verify that the display contrast is fully adjustable.
46. Power the unit down by pressing the ⏻ (power) key and unplug the unit from AC power.
47. Power the unit up on battery and verify that it functions properly.
48. Power the unit down by pressing the ⏻ (power) key.
49. This completes the Functional Tests for the *CO_2SMO Plus!*.

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Section 5 Accuracy Tests

The Accuracy Test verifies the performance accuracy of the Model 8100. This test is typically performed in conjunction with (after) the Functional Tests described on page 39. If the monitor does not pass the accuracy test, contact the Novametrix Service Department for repair/replacement assistance.

This procedure assumes the technician performs each step as indicated—leaving the monitor in a known state prior to performing the next step. If steps are omitted or performed out of order, be sure that the monitor is set to the correct state before continuing.

5.1 Equipment Required

1. Mercury Barometer
2. CAPNOSTAT CO_2 Sensor, Catalog No. 7167-00
3. Nasal Cannula Tubing Set, Catalog No. 8781-00
4. Adult Airway Adapter, Catalog No. 7007-01
5. Model 1298 Gas Regulator, Catalog No. 6081-00*
   Low point calibration gas, Catalog No. 8364
   This device is used for gas flow control in checking the CAPNOSTAT CO_2 sensor and monitor. Use only Novametrix supplied Calibration Gas with this device.
6. TB500B Test Box, Catalog No. 5330-00*
   This is the same device used by the factory technicians to calibrate the monitor prior to shipping. The TB500B is an updated version of the TB500A Test Box. The TB500A, used in conjunction with adapter cable (Catalog No. 5453-00), may be substituted for the TB500B in most parts of this test.
7. SpO_2 Finger Sensor, Catalog No. 8776-00
8. Adult Flow Sensor, Catalog No. 6717-01
9. Neonatal Flow Sensor, Catalog No. 6718-01
10. 1 Liter (1000 ml) Calibration Syringe, Catalog No. 550020
11. Adult Combined CO_2/Flow Sensor, Catalog No. 6719-01
    *Calibrated

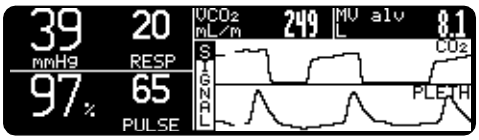
5.2 Test Procedure

5.2.1 Start up

1. Visually inspect the monitor and verify there are no cosmetic defects.
2. Verify proper fuses and voltage setting on the rear panel. See “Mains Voltage Configuration” on page 63.
3. Attach the line cord and set the rear panel power switch to “|”.
4. Verify the green ∿ AC ON symbol on the front panel illuminates. Press the % (power) key.
5. When the monitor powers up, a self-test is performed in which all indicators will temporarily illuminate and the monitor will emit two short beeps. Following the self-test the monitor will display:

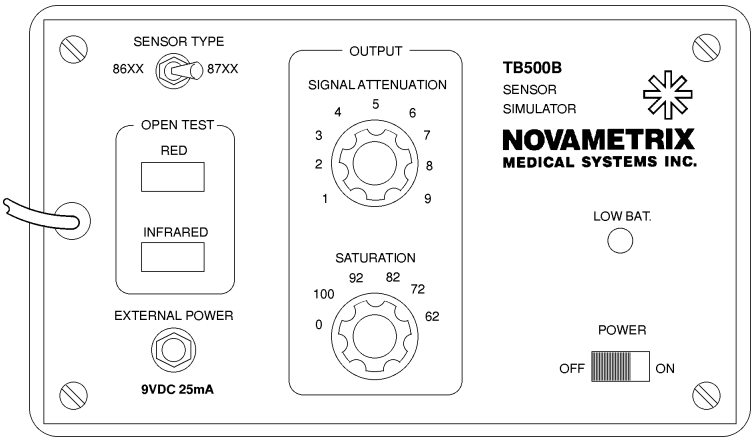
   “ERASE STORED TRENDS?
   YES: △ NO: ▽”

   If the △ or ▽ key is not pressed within five seconds, trends will be retained. The monitor is now ready for operation.
6. Press the CO_2/PLETH key until the CO_2 / PLETH waveform screen is displayed.



5.2.2 SpO_2 Test

7. Set the controls on the TB500B as follows:
   - SENSOR TYPE: 87XX
   - SIGNAL ATTENUATION: 1
   - SATURATION SETTING: 100
   - POWER: ON



8. Connect the TB500B to the rear panel SpO_2 INPUT. Verify the saturation values listed below:

*SATURATION SETTING on TB500B:	SIGNAL ATTEN on TB500B:	SATURATION % on monitor DISPLAY:
100	3	98-100
92	3	90-94
82	3	80-84
72	3	70-74
62	3	60-64
72	7	68-76
82	7	78-86
92	7	88-96
100	7	98-100

* Verify the pulse rate is 60 ± 1 bpm for each Saturation Setting.

Note: When a parameter limit is passed an alert should occur. Reset the alert for that specific parameter by first pressing the SET ALERTS key then the NEXT key in conjunction with the △ ▽ keys to adjust the limit beyond the alerted value.

9. Set the TB500B **SIGNAL ATTENUATION** to **1**, verify "PROBE OFF" appears on the display and an alert condition occurs. Reset the TB500B **SIGNAL ATTENUATION** to **3** and verify the alert resets.
10. Press and hold the **INFRARED** button on the TB500B and verify an alert occurs with the message "FAULTY PROBE 1" displayed. Release the button to reset the alert.
11. Press the **RED** button on the TB500B and verify an alert occurs with the message "FAULTY PROBE 2" displayed. Release the button to reset the alert.
12. Remove the TB500B from the monitor and verify an alert condition.
13. Connect a finger sensor to the rear panel SpO_2 INPUT and place the sensor over your finger. Verify a reasonable reading for both SpO_2 and pulse rate.
14. Remove your finger from the sensor and verify an alert condition with "PROBE OFF" displayed. Press the 🔕 key and verify the alert is reset. Unplug the sensor from the unit.

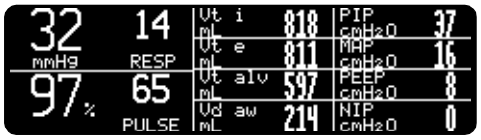
5.2.3 CO_2 Test

15. Connect the CAPNOSTAT CO_2 sensor to the monitor. After it has warmed up, follow the display prompts and calibrate the CAPNOSTAT. Verify it passes calibration.
16. Place the airway adapter on the CAPNOSTAT. Verify the monitor displays "PUT CO2 SENSOR ON ADAPTER IN ROOM AIR OK: △ CANCEL ▽ ". Press △ to continue.
17. Press and hold the SETUP key until the CONFIGURATION screen appears. Press NEXT to select CO2 AVG:, use the arrow keys to select INST. Press the CO_2/ PLETH key.
18. Connect the low point calibration gas to the Model 1298 Gas Regulator then connect to the adult airway adapter, refer to the instruction supplied with the Model 1298 for more information.

19. Flow the calibration gas, verify a CO_2 value of 38 ± 2.
20. Press the SETUP key and turn the CO_2 SAMPLE PUMP on using the NEXT and △▽ keys. Press the NEXT key to "CO_2 ZERO NOW": then press the △ key and follow the prompts to calibrate the CAPNOSTAT on the nasal cannula.
21. Breathe into the nasal cannula and verify reasonable values and waveform for $ETCO_2$. Press the EVENT/ FREEZE key, verify the waveform is frozen and the event is marked with the correct time. Press the EVENT/ FREEZE key again.
22. Block first the intake tubing and then the exhaust port of the sampling system, in both cases verify an "OCCLUSION?" message appears when blocked.
23. Discontinue breathing into the cannula and verify that an alert condition occurs and a "NO RESP X:XX" message is displayed (X:XX = time).
24. Press and hold the audio key, verify the audio is off and the alert has not been reset.
25. Remove the CAPNOSTAT and cannula tubing from the unit.
26. Press the SETUP key and shut off the sample pump using the △ key. Press the SETUP key to return to the main menu.

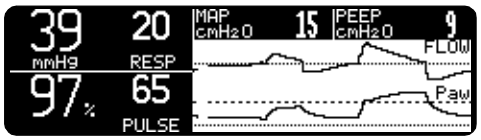
5.2.4 Flow Test

27. Connect the 6717-01 Adult Flow Sensor to the unit and verify that the adult flow sensor is identified. Connect the flow sensor to the 1000ml calibration syringe.
28. Press the DATA key until the Vt i / Vt e screen appears:



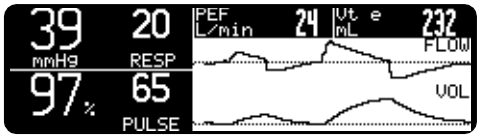
29. Pump the syringe fully back and forth with a steady motion at a rate of 20 cycles per minute for each of the following tests:
    - Verify a Vti and Vte of 1000ml (± 50ml).
    - Press the FLOW/ PRES key and verify the Flow/Pressure waveforms are appropriately displayed:

Flow/Pressure Waveforms



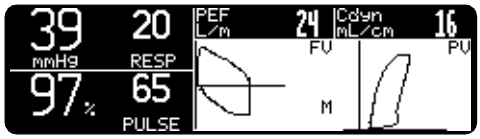
- Press FLOW/ PRES again and verify the Flow/Volume waveforms are appropriately displayed:

Flow/Volume Waveforms



- Press FLOW/ PRES once more and verify the Flow/ Pressure Volume Loop waveforms are appropriately displayed:

Flow/Pressure Volume Loops



30. Remove the flow sensor and syringe from the unit and verify “FLOW SENSOR DISCONNECTED” is displayed.
31. Install the Neonatal Flow Sensor (Cat. No.: 6718-01) and verify “NEONATAL FLOW SENSOR IDENTIFIED” is displayed. Remove the sensor from the unit.
32. Install the Combined CO_2/Flow Sensor (Cat. No.: 6719-01) and verify “ADULT CO2/FLOW SENSOR IDENTIFIED” is displayed. Remove the sensor from the unit.
33. Press and hold the ◐ key and verify that the contrast of the display is fully adjustable.
34. Power the unit down by pressing the %⏻ key and unplugging the unit from AC power.
35. Power the unit up on battery and verify that it functions properly.
36. Power the unit down by pressing the %⏻ key.

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Section 6 *Electronic Tests*

The Electronic Tests verify the calibration and operation of the electronic circuits within the *CO_2SMO Plus!* Model 8100. These tests DO NOT need to be performed on a regular (preventative) basis. Perform these tests only if the monitor fails to operate as expected or fails the Functional Tests on page 39 and/or Accuracy Tests on page 43. The Electronic Tests should be performed only by qualified service personnel.

The Electronic Tests require access to the internal components of the monitor. Refer to page 66 for disassembly instructions.

CAUTION

The Model 8100 contains static sensitive devices. Be sure to follow proper grounding procedures when handling the internal components to avoid damage from static discharge.

If the monitor does not pass an Electronic Test, remove it from use and contact the Novametrix Service Department for repair/replacement assistance.

This procedure assumes the technician performs each step as indicated—leaving the monitor in a known state prior to performing the next step. If steps are omitted or performed out of order, be sure the monitor is set to the correct state before continuing.

6.1 General

The Model 8100 must have the top cover removed to expose the internal electronic circuit boards. Refer to page 66 for disassembly instructions.

6.1.1 Equipment Required

1. Mercury barometer*
2. TB1265 Sensor Simulator* (Cat. No. 5778-00):
   The Novametrix TB1265 Sensor Simulator emulates a functioning CAPNOSTAT® CO_2 sensor, and can be used in place of the (PN: 7167) CAPNOSTAT for *CO_2SMO Plus!* $ETCO_2$ monitor test purposes. The TB1265 will verify the functionality of the monitor's CO_2 front end circuitry. Certain error conditions can be simulated by the sensor simulator to verify responses from the monitor under test.
   The TB1265 is an optional test device and is not mandatory for testing the *CO_2SMO Plus!*. Its purpose is to increase test efficiency by simulating a working CAPNOSTAT. The TB1265 Sensor Simulator is available from the Novametrix Service Department.
3. Flow meter / Sampling Cannula test fixture, see page 56.
4. TB500B Saturation simulator* (Cat. No. 5330-00)
   This is the same device used by the factory technicians to calibrate the monitor prior to shipping. The TB500B is an updated version of the TB500A Test Box. The

TB500A, used in conjunction with adapter cable (Cat. No. 5453-00), may be substituted for the TB500B for most parts of this test.

5. 6717-48 Adult flow sensor test jack or sensor
   - 6718-48 Neonatal flow sensor test jack or sensor
   - 6719-48 Combined sensor test jack or sensor
   - Pennwalt pneumatic calibrator* or equivalent
   - D.V.M.*
     *Calibrated

6.2 Power Supply Testing

1. Connect the line cord to the monitor and plug into the AC line. Switch the rear panel power switch to "|". Verify the green AC ON ∿ symbol on the front panel illuminates.
2. Measure the following voltages (use TP19 as ground reference for all measurements unless otherwise specified):

Supply Name	Location	Voltage Range
VDCIN	IC86 PIN 5	22.00 V ± 4.0V
VHTR	C251 POSITIVE	12.00 V ± 0.6V
VBKLITE	C261 POSITIVE	12.00 V ± 0.6V
VBACK	IC4 PIN 32	2.20 V ± 0.2V

3. Press the front panel power button ⏻ to turn the monitor on.
4. Measure the following power supply voltages (use TP19 as ground reference for all measurements unless otherwise specified):

Supply Name	Location	Voltage Range
VDD	IC62 PIN 20	5.00 V ± 0.15V
VBACK	IC4 PIN 32	4.70 V ± 0.2V
+VA	IC85 PIN 3	15.00 V ± 2.0V
+12V	IC85 PIN 2 (Tab)	12.00 V ± 0.5V
+VSRC	IC87 PIN 2 (Tab)	12.00 V ± 0.5V
-VA	IC90 PIN 2	-15.00 V ± 2.0V
-12V	IC90 PIN 3	-12.00 V ± 0.5V
-VSRC	IC89 PIN 3	-12.00 V ± 0.5V

5. Measure the following reference voltages (use TP19 as ground reference for all measurements unless otherwise specified):

Supply Name	Location	Voltage Range
VREF0	IC70 PIN 6	2.50 V ± 25mV
2CVREF	C207 POSITIVE	5.00 V ± 50mV
-2CVREF	C253 NEGATIVE	-5.00 V ± 50mV

CVREF	C209 POSITIVE	2.50 V ± 25mV
2VREF0	C212 POSITIVE	5.00 V ± 50mV
VREF0/2	IC53 PIN 4	1.25 V ± 25mV

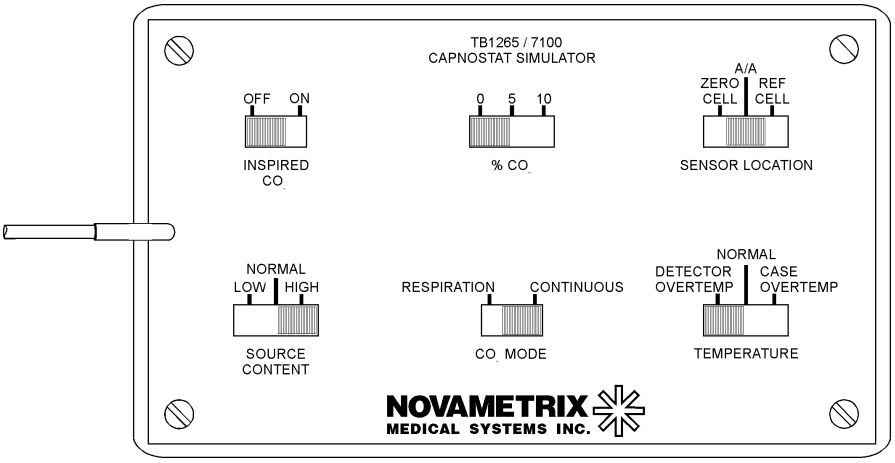
6. Measure the following isolated voltages: * Use TP18 as ground reference

Supply Name	Location	Voltage Range
IRAW	IC82 PIN 3	9.00 V ± 1V
IVDD	IC82 PIN 2 (Tab)	5.00 V ± 0.2V

7. Switch the rear panel mains switch to “O”. Verify the AC ON symbol turns off and the battery icon is displayed.
8. Switch the rear panel mains switch to “|”. Verify the AC ON symbol turns on and the battery icon disappears.
9. Press and hold the contrast key. Verify the display intensity changes from light to dark. Set the intensity to a normal level.

6.3 CO_2 Testing

10. Set the TB1265 switches as follows:
    - Inspired CO2: OFF
    - % CO2: 0
    - Sensor Location: ZERO CELL
    - Source Current: NORMAL
    - CO2 Mode: CONTINUOUS
    - Temperature: NORMAL



11. Verify “CO_2 SENSOR ?” is displayed in the $ETCO_2$ window.
12. Connect the TB1265 to the *CO_2SMO Plus!*. Verify “CO_2 WARM UP” is displayed in the $ETCO_2$ window.

13. Display the $ETCO_2$ engineering screens by simultaneously pressing and holding the SETUP key and the DATA key for five seconds. Press the NEXT key until Screen 2 (# in lower right corner) appears.
14. Verify the CASET and DETT slowly rise and stabilize at 45.00 °C within 2 minutes.
15. Verify the SRCCUR is between 250 and 300.
16. Change the TEMPERATURE switch on the TB1265 to CASE OVER TEMP. Verify the following:
    - CASET > 50.00
    - C30 pin 7 is low
    - TP3 is low
17. Change the TEMPERATURE switch on the TB1265 back to NORMAL.
18. Verify the CASET stabilizes to 45.00 °C within 2 minutes.
19. Change the TEMPERATURE switch on the TB1265 to DETECTOR OVER TEMP. Verify the following:
    - DET TEMP > 50.00
    - C30 pin 1 is low
    - TP5 is low
    - An audible alarm with the alert bar flashing
20. Press the AUDIO OFF key.
21. Change the TEMPERATURE switch on the TB1265 back to NORMAL.
22. Verify the DETT stabilizes to 45.00 °C within 2 minutes. Verify the alert bar turns off.
23. Read the current barometric pressure from the calibrated barometer.
24. Using the NEXT key display the Flow engineering screen (Screen 3).
25. Adjust VR4 until the TOTALP equals the recorded barometric pressure.
26. Press the ⌃ key to zero the *CO_2SMO Plus!*.
27. Using the NEXT key change back to the $ETCO_2$ engineering screen (Screen 2).
28. Verify the BAROP equals the TOTALP ± 1 set in the previous step.
29. Zero calibrate the TB1265 by pressing the ⌄ key.
30. Verify the DATACH and REFCH are 3600 ± 100.
31. Change the SENSOR LOCATION switch on the TB1265 to REF CELL.
32. Verify the CO_2 equals 38.0 ± 2.0.
33. Change the SENSOR LOCATION switch on the TB1265 to A/A.
34. Connect the Flow Meter / Sampling Cannula test fixture to the *CO_2SMO Plus!*.
35. Press the SETUP key to access the SETUP screen.
36. Press the NEXT key until the selection arrow is beside SAMPLE PUMP.
37. Press the ⌃ key to turn the sample pump on.
38. Verify the sampling pump turns on.

39. Adjust VR1 for a flow rate of 180 ccm ± 1 ccm. Record the flow rate.
40. Press the NEXT key until the selection arrow is beside CO_2 ZERO NOW.
41. Press the ⌃ key.
42. Verify the *CO_2SMO Plus!* screen changes back to the main screen. Verify an "ATTACH CANNULA AND SAMPLE ROOM AIR" message is displayed in the $ETCO_2$ window.
43. Press the ⌃ key again to start an airway calibration. Verify the adapter calibration completes.
44. Change the % CO_2 switch on the TB1265 to 5.
45. Change the CO_2 MODE switch on the TB1265 to RESPIRATION.
46. Verify an $ETCO_2$ reading of 40 ± 2 and a respiration rate of 20 ± 2. Record the values.
47. Change the INSPIRED CO_2 switch on the TB1265 to ON.
48. Verify an inspired CO_2 value of 5 ± 2. Record the value.
49. Change the INSPIRED CO_2 switch on the TB1265 to OFF.
50. Change the % CO_2 switch on the TB1265 to 10.
51. Verify an $ETCO_2$ reading of 80 ± 4 and a respiration rate of 20 ± 2. Record the values.
52. Block the *CO_2SMO Plus!* flow output port.
53. Verify an "OCCLUSION?" message is flashing in the $ETCO_2$ window.
54. Remove the blockage from the *CO_2SMO Plus!*.
55. Verify the "OCCLUSION?" message clears.
56. Kink the Cannula line.
57. Verify an "OCCLUSION?" message is flashing in the $ETCO_2$ window.
58. Remove the blockage from the Cannula line.
59. Verify the "OCCLUSION?" message clears.
60. Disconnect the Flow Meter / Sampling Cannula test fixture from the *CO_2SMO Plus!*.
61. Verify a "SAMPLING LEAK?" message is flashing in the $ETCO_2$ window.
62. Reconnect the Flow Meter / Sampling Cannula test fixture to the *CO_2SMO Plus!*.
63. Verify the "SAMPLING LEAK?" message clears.
64. Press the SETUP key.
65. Press the NEXT key until the selection arrow is beside SAMPLE PUMP.
66. Press the ⌃ key.
67. Verify the sampling pump turns off.
68. Disconnect the TB1265 and the Flow Meter / Sampling Cannula test fixture.

6.4 Saturation Testing

** An audible alarm with the alert bar flashing will occur when the saturation setting drops below certain preset limits or when any of the sensor error tests are done. Press and hold the AUDIO OFF key. The audible alert should shut off while the alert bar continues flashing.

69. Press the CO2/PLETH waveform key until the PLETH waveform screen is displayed.
70. Connect the TB500B to the *CO_2SMO Plus!*.
71. Verify the Saturation and Pulse value for the following TB500B Saturation and Pulse settings:

Test Box Switch Settings		Displayed Saturation
Saturation Setting	Signal Attenuation	Tolerance Range
100	3	98 - 100
82	3	80 - 84
62	3	60 - 64
72	7	68 - 76
92	7	88 - 96

Verify Pulse rate is 60 ± 2 for all settings

72. Set the SIGNAL ATTENUATION switch on the TB500B to “1”
73. Verify a “PROBE OFF” message is displayed in the SPO_2 window.
74. Set the SIGNAL ATTENUATION switch on the TB500B to “3”.
75. Verify the “PROBE OFF” message clears.
76. Set the SATURATION switch on the TB500B to “0”.
77. Verify a “LOW SPO_2 SIGNAL, CHANGE SITE” message is displayed in the SPO_2 window.
78. Set the SATURATION switch on the TB500B to “100”.
79. Verify the “LOW SPO_2 SIGNAL, CHANGE SITE” message clears.
80. Turn the TB500B off.
81. Verify a “LOW LIGHT, CHANGE SITE” message is displayed in the SPO_2 window.
82. Turn the TB500B on.
83. Verify the “LOW LIGHT, CHANGE SITE” message clears.
84. Press and hold the RED open test button on the TB500B.
85. Verify a “FAULTY PROBE 2” message is displayed in the SPO_2 window.
86. Release the RED open test button.
87. Verify the “FAULTY PROBE 2” message clears.
88. Press and hold the INFRARED open test button on the TB500B.
89. Verify a “FAULTY PROBE 1” message is displayed in the SPO_2 window.
90. Release the INFRARED open test button.
91. Verify the “FAULTY PROBE 1” message clears.
92. Disconnect the TB500B.

6.5 Flow Testing

93. Display the FLOW engineering screen (Screen 3) by simultaneously pressing and holding the SETUP and DATA key for five seconds. Use the NEXT key to advance to the Flow screen.
94. Verify “(0) NONE” is displayed next to SENSOR.
95. Connect the 6717-48 test jack to the flow sensor input on the *CO_2SMO Plus!*.
96. Verify “(6) 6717” is displayed next to SENSOR.
97. Connect the 6718-48 test jack to the *CO_2SMO Plus!*.
98. Verify “(3) 6718” is displayed next to SENSOR.
99. Connect the 6719-48 test jack to the *CO_2SMO Plus!*.
100. Verify “(5) 6719” is displayed next to SENSOR.
101. Disconnect the test jack.
102. Connect the 6935-48 leak test adapter to the *CO_2SMO Plus!*.
103. With the stop cock on the leak test fixture open set an AIRP reading of 100 - 110 cmH_2O.
104. Close the stop cock.
105. Verify the AIRP remains the same for at least 30 seconds.
106. Disconnect the leak test adapter.
107. Connect the 6936-48 test fixture to the *CO_2SMO Plus!*.
108. Connect the pneumatic calibrator output to the left port of the 6936-48 test fixture.
109. Set the pneumatic calibrator (Pennwalt) for an output pressure of 20 cmH_2O.
110. Adjust VR2 for a “X1” value of 1610 ± 5.
111. Switch the pneumatic calibrator output from the left port of the 6936-48 test fixture to the right port.
112. Verify a “X1” value of -1610 ± 50.
113. Disconnect the 6936-48 test fixture.
114. Connect the 6937-48 test fixture to the *CO_2SMO Plus!*.
115. Connect the pneumatic calibrator output to the 6937-48 test fixture.
116. Set the pneumatic calibrator (Pennwalt) for an output pressure of 80 cmH_2O.
117. Adjust VR3 for a AIRP reading of 80.00 cmH_2O ± 0.1 cmH_2O.
118. Disconnect the pneumatic calibrator from the 6937-48 fixture.
119. Press the △ key to purge the *CO_2SMO Plus!*. Verify the purge pump turns on.
120. Disconnect the 6937-48 test fixture.

6.6 Barometric Pressure

The monitor determines the barometric pressure from an internal sensor. This sensor has been calibrated at the factory and should not need readjustment with normal use. To verify the barometric pressure or to adjust the barometric pressure if necessary, perform the following steps; otherwise proceed to the next section.

1. With the monitor on, simultaneously press and hold the DATA and SETUP keys until the engineering menu appears. Press the NEXT key to advance to the $ETCO_2$ screen (2).
2. Check the current barometric pressure using a calibrated barometer. Verify the "BAROP" value corresponds to the barometric pressure within one count. If not, adjustment of VR4 on the CPU-Interface board may be necessary. Refer to page 52.

6.7 Isolation and Leakage Checks

1. Assemble the unit completely. Attach the line cord to the rear panel of the monitor.
2. Apply 2.5KVAC for sixty seconds between earth ground and the shorted hot and neutral of the linecord. Verify there is no arcing or leakage.
3. Apply 4.0KVAC for sixty seconds between the shorted SpO_2 INPUT connections and the shorted hot and neutral of the linecord. Verify there is no arcing or leakage.
4. Apply 1.5KVAC for sixty seconds between the shorted SpO_2 INPUT connections and earth ground. Verify there is no arcing or leakage.
5. Measure the monitor's leakage current as listed. Verify a leakage current less than 25uA
   - Monitor grounded
   - Monitor ungrounded
   - Monitor ungrounded with polarity reversed
6. Measure the monitor's AC leakage from the shorted SpO_2 INPUT connections (located on rear panel) to the hot side of the AC line.
7. Verify a leakage current less than 25uA.

6.8 Test Fixtures

Flow Meter/Sampling Cannula test fixture, parts list:

Quantity	Part Number	Description
1		Mass flow meter, Aalborg GFM17 or equivalent
1	5843-01	Sampling Airway Adapter with tubing
1	8781-02	Nasal CO_2 Sampling Cannula - Adult
1	160038	50/50 mix of THF and Cyclohexanone (solvent)
1	250110	1/8" Y-fitting
1	315062	Dehumidification tubing
1	608106	1/8" ID PVC tubing (1 1/2" length)
2	608114	3/32" ID PVC tubing (1" length)

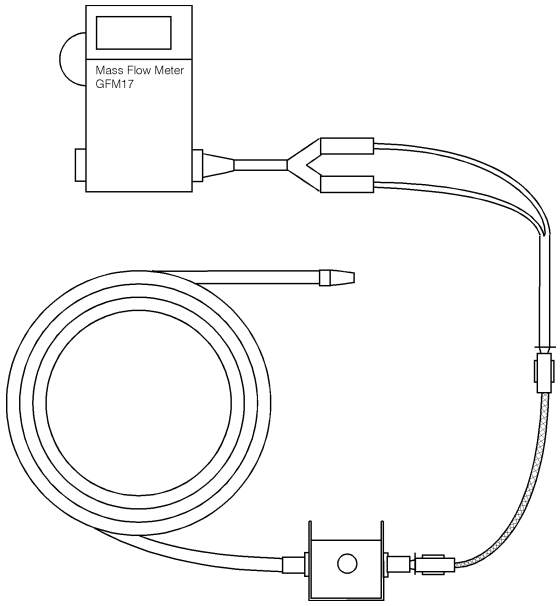
6.9 Test Fixture Construction

6.9.1 Sampling Cannula Modification:

1. Cut the right and left side tubing from the nasal prong portion of the 8781-01 Nasal CO_2 Sampling Cannula. Make the cut as close as possible to the nasal prong assembly.
2. Using the following procedure, solvent bond each of the cut tubes to one of the 3/32" I.D. PVC tubes.
   - Dip the left side tube into the 50/50 mix of THF and Cyclohexanone solvent for *one* second.
   - Blot the end of the tube on a piece of paper to remove any excess solvent that might be inside the tube.
   - Insert the tube about 1/4" into the end of the 3/32" I.D. PVC tubing.
   - Allow to bond for five minutes. Verify that both tubes are not occluded in any way.
   - Repeat steps a-d for the right side tube.
3. Connect both free ends of the 3/32" I.D. PVC tubing to the 1/8" Y-fitting.
4. Connect the 1/8" I.D. PVC Tubing to the output end of the Y-fitting.

6.9.2 Test Fixture Assembly

1. Insert the male end of the Dehumidification Tube into the female end of the Sampling Adapter (note: the Sampling Adapter is part of 5843-01).
2. Insert the male end of the modified Nasal CO_2 Sampling Cannula into the female end of the Dehumidification Tube.
3. Slide the 1/8" I.D. PVC tubing from the modified Nasal CO_2 Sampling Cannula onto the outlet port barb on the Mass Flow Meter.



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Section 7 Maintenance

7.1 General

This section presents recommended maintenance schedules for the *CO_2SMO Plus!* Model 8100, and information on general maintenance, such as battery and fuse replacement, disassembly and assembly instructions, and system software updates.

7.2 Maintenance Schedules

The electronic circuits within the Novametrix Model 8100 monitor do not require scheduled calibration or service. However, in order to maximize battery life, the monitor's internal battery should be tested monthly. Novametrix recommends the following maintenance schedules.*

- Cleaning and Sterilization:
  Perform as required. See page 60.
- Battery Maintenance:
  Contains information on charging the internal battery. See page 65.
- Functional Tests:
  The test verifies overall functional integrity of the monitor and sensors. See page 39.
- Accuracy Tests:
  The test verifies the calibration accuracy of the monitor using specified test apparatus. See page 43.
- Electronic Tests:
  These tests contain information on calibrating the electronic circuits within the Model 8100 and should only be performed if the monitor fails to pass the Functional Tests. Only qualified service personnel should attempt to perform the Electronic Tests. See page 49.
- Barometric Pressure:
  This procedure enables verifying the automatic barometric pressure reading of the monitor. See page 56.
- Safety Checks:
  These tests contain information on hipot and leakage testing of the monitor. See page 56.

*. At the customer's request, Novametrix will provide repair and calibration services under terms of a Service Contract. Contact the Novametrix Service Department for contract details.

7.3 Cleaning and Sterilization

Follow the cleaning and sterilization instructions listed below to clean and/or sterilize the monitor and its accessories.

7.3.1 Monitor

- Turn the monitor off and unplug the line cord from the AC line before cleaning.
- The monitor can be cleaned and disinfected with solutions such as a 70% isopropyl alcohol, 2% glutaraldehyde, or 10% bleach solution. Then wipe down with a water-dampened clean cloth to rinse. Dry before use.
- Do not immerse the monitor.
- Do not attempt to sterilize the monitor.

7.3.2 SpO_2 Finger Sensor

- The sensor can be cleaned and disinfected with solutions such as a 70% isopropyl alcohol, 2% glutaraldehyde, or 10% bleach solution. Then wipe down with a water-dampened clean cloth to rinse. Dry before use.
- Make certain that the finger sensor windows are clean and dry before reuse.
- Do not immerse the finger sensor.
- Do not attempt to sterilize the finger sensor.
- After cleaning the finger sensor, verify that the sensor is physically intact, with no broken or frayed wires or damaged parts. Make certain that the connectors are clean and dry, with no signs of contamination or corrosion. Do not use a broken or damaged sensor or one with wet, contaminated or corroded connectors.

7.3.3 SpO_2 Y-Sensor

- Do not immerse connector on the Y-Sensor.
- The Y-Sensor may be immersed—up to, but not including, the connector, in a 2% glutaraldehyde solution, or 10% bleach solution. Refer to manufacturer's instructions and standard hospital protocols to determine recommended times for disinfection and sterilization.
- Rinse thoroughly with water and dry before use (do not rinse the connector).
- Do not attempt to sterilize Y-Sensor except as stated above.
- After cleaning or sterilizing the Y-Sensor, verify that the sensor is physically intact, with no broken or frayed wires or damaged parts. Make certain that the connectors are clean and dry, with no signs of contamination or corrosion. Do not use a broken or damaged sensor or one with wet, contaminated, or corroded connectors.

7.3.4 SpO_2 Y-Strip Tapes and Foam Wraps

- Treat Y-Strip Tapes and foam wraps in accordance with hospital protocol for single-patient use items.

7.3.5 Ear Clip

- Do not immerse the ear clip.
- Clean the ear clip with a cloth dampened with 70% isopropyl alcohol. After cleaning, wipe the ear clip down thoroughly with a clean water-dampened cloth to rinse.

7.3.6 Flow Sensors and Combined CO_2/Flow Sensors

- Treat all flow and CO_2/flow sensors in accordance with hospital protocol for single-patient use items.

7.3.7 CAPNOSTAT CO_2 Sensor

- Clean the sensor surface with a damp cloth.
- Make certain that the sensor windows are clean and dry.
- Do not immerse the CAPNOSTAT CO_2 sensor.
- Do not attempt to sterilize the CAPNOSTAT CO_2 sensor.

7.3.8 Reusable Adult Airway Adapter

- The Adult Airway Adapter (Cat. No. 7007) may be cleaned by rinsing in a warm soapy solution, followed by soaking in a liquid disinfectant, pasteurized, or sterilized by soaking in glutaraldehyde. It should then be rinsed with sterile water and dried.
- The Adult Airway Adapter (Cat. No. 7007) may be sterilized using either steam autoclave or ETO (ethylene oxide) gas methods. Be sure to use appropriate aeration times.
- Before reusing the adapter, ensure that the windows are dry and residue-free, and that the adapter has not been damaged during handling or by the cleaning/sterilization process.

7.3.9 Reusable Neonatal Airway Adapter

- The Neonatal Airway Adapter (Cat. No. 7053) may be cleaned by rinsing in a warm soapy solution, followed by soaking in a liquid disinfectant, pasteurized, or sterilized by soaking in glutaraldehyde. It should then be rinsed with sterile water and dried.
- The Neonatal Airway Adapter (Cat. No. 7053) may be sterilized using ETO (ethylene oxide) gas. Be sure to use appropriate aeration times.
- Before reusing the adapter, ensure that the windows are dry and residue-free, and that the adapter has not been damaged during handling or by the cleaning/sterilization process.

7.3.10 External Sampling System Components

- The Nasal Sampling Cannulas are for single-patient use.
- The Sampling Adapter with tubing (Cat. No. 5843) may be cleaned by rinsing in a warm soapy solution, followed by soaking in a liquid disinfectant. It should then be rinsed with sterile water and dried.

7.3.11 Single Patient Use Airway Adapters

- Treat all single patient use airway adapters in accordance with hospital protocol for single-patient use items.

7.3.12 Internal Sampling System Components

Acceptable fluids for cleaning and sterilizing the internal pneumatic parts of the Sampling System include isopropyl alcohol, Cidex† or equivalent, or a 5.25% water solution by weight of sodium hypochlorite (bleach).

CAUTION

Do not attempt to pump cleaning/sterilizing liquid with the sampling pump. This may cause accelerated wear on the pump bearings. Always flush liquids with a syringe as described in the following instructions.

To clean and disinfect the pumping system:

1. Turn the monitor off and disconnect the AC line cord.
2. Remove both the sampling inlet tubing set and the sampling exhaust tubing (if any).
3. Attach an exhaust port line (1/8 inch or 3/16 inch I.D. tubing) from the Sampling Exhaust port to a suitable container located below the bottom level of the monitor.
4. Use a 60 cc catheter tip syringe. Fit it to the SAMPLING SYSTEM INLET connector. Flush the sterilizing solution slowly through the pumping system. Push the entire 60 cc of solution through the SAMPLING INLET. Repeat this process two more times to use a total of 180 cc of solution.
5. Remove the syringe and leave the cleaning/sterilizing fluid within the sampling pump system for 30 minutes to disinfect the system. Follow sterilant manufacturer's instructions for disinfection.
6. After 30 minutes, fill the syringe with distilled water and flush the system three times. Allow the cleaning/disinfection solution and distilled water to drain through the SAMPLING EXHAUST output.
7. Push several syringes of air slowly through the system to ensure that most of the liquid has been drained.
8. Follow this with at least three more syringes of distilled water, followed by at least two more syringes of air to make sure that most of the distilled water has been drained.
9. Remove the syringe from the unit. Do not connect the sampling inlet tubing. Connect the AC line cord and turn the monitor on. Allow the sampling pump to operate for several minutes. This will help to remove any trapped water.
10. Connect a sampling tubing set to the SAMPLING SYSTEM INLET.
11. Block the open end of the tubing with your finger. Alternate blocking and unblocking the tubing end at least ten times. Use a quick, brisk motion when blocking and unblocking the tubing. Keep the tubing blocked and unblocked for several seconds at a time.
12. Repeat the same blocking and unblocking action with your finger on the sampling exhaust port.
13. Allow the sampling system to run for at least 30 minutes without the sampling assembly tubing and the sampling exhaust tubing connected. This will speed dry the system pneumatics.
14. Once these cleaning and disinfection instructions have been completed, normal sampling system operation can be resumed. See "Sampling Airway Adapter."

†. Cidex is a trademark of Arbook, Inc.

7.4 Mains Voltage Configuration

The rear panel power entry module indicates the Mains voltage setting for the monitor. Check that the voltage is correct before attaching the AC line cord and powering the monitor. The *CO_2SMO Plus!* can be set to operate from 100-120 VAC 50/60Hz or 200-240VAC 50/60Hz.

Instructions for fuse replacement and changing the Mains voltage setting follow.

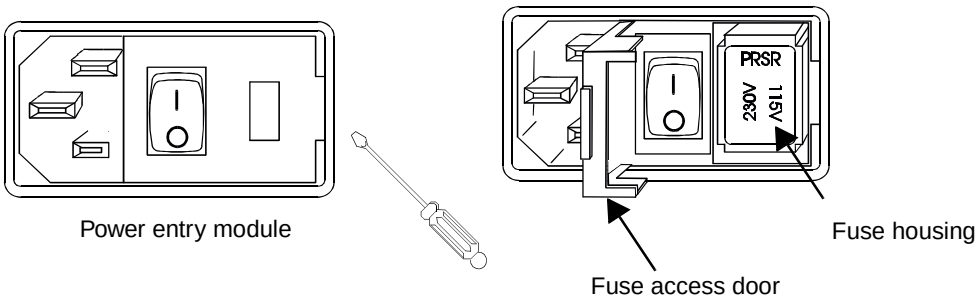
CAUTION

Replace fuses with same type and rating. Verify proper fuse value for Mains voltage setting (see table below).

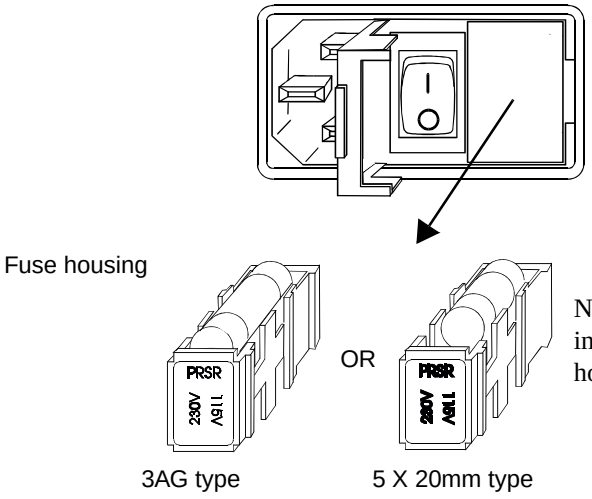
7.4.1 Fuse Replacement

1. Check that the monitor is OFF.
2. Set the rear panel power entry module switch to OFF (“O”). Remove the AC line cord from the power entry module.
3. Using a flat blade screwdriver, pry the fuse access door open to expose the fuse housing. Note the orientation of the fuse housing (this determines the Mains operating voltage).

Mains Voltage	Fuses (Slo Blo)
100-120 VAC	0.5 A 250V
200-240 VAC	250mA 250V

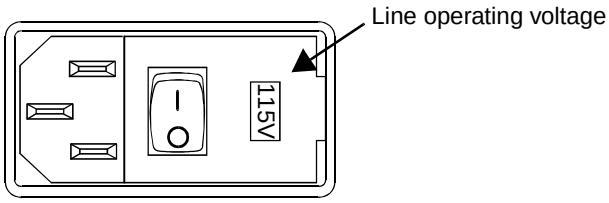


4. Pry the fuse housing out from the power entry module.



NOTE: 5 mm X 20 mm fuses are installed toward the “back” of the fuse housing as shown

5. Replace the blown fuse(s) with the proper type and rating.
6. Reinstall the fuse housing. When positioning the housing into the power entry module make sure that it is oriented correctly. Press the fuse housing back into the power entry module.
7. Close the fuse access door and verify that the proper Mains operating voltage is displayed.



7.4.2 Changing the Mains Voltage Setting

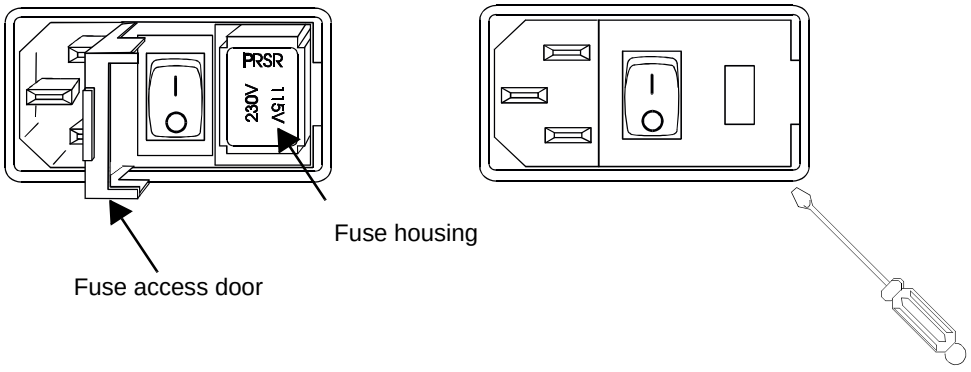
1. Check that the monitor is OFF.
2. Set the rear panel power entry module switch to OFF (“O”). Remove the line cord from the power entry module.

CAUTION

Replace fuses with same type and rating. Verify proper fuse value for Mains voltage setting (see table below).

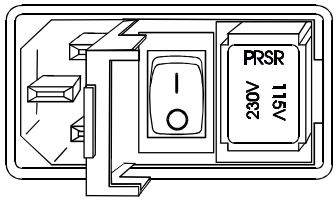
Mains Voltage	Fuses (Slo Blo)
100-120 VAC	0.5 A 250V
200-240 VAC	250mA 250V

3. Using a flat blade screwdriver, pry the fuse access door open to expose the fuse housing. Pry the fuse housing out from the power entry module.

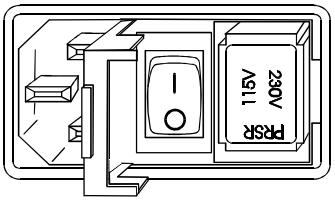


4. Install the proper type and rating fuse for the Mains voltage setting required.

5. Position the housing into the power entry module so that the desired voltage is furthest away from the switch (see below).

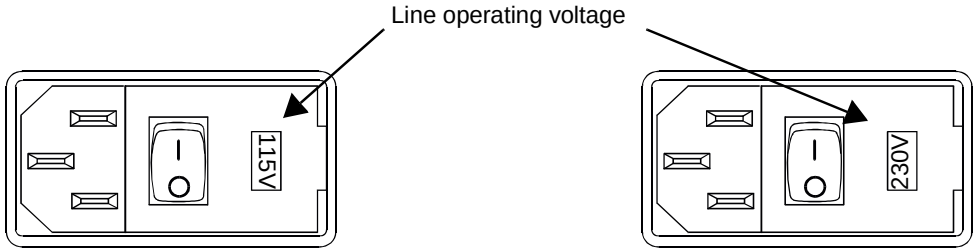


Set for 100-120V operation



Set for 200-240V Operation

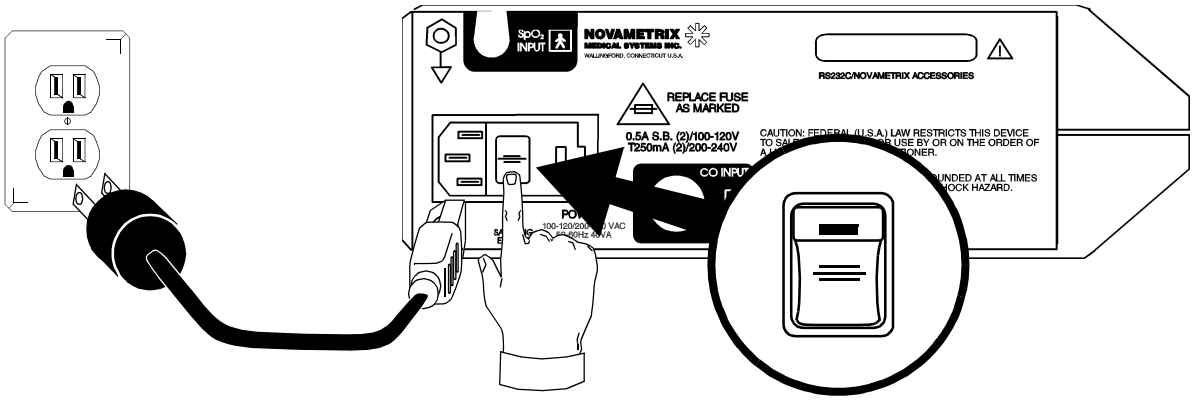
6. Close the fuse access door and verify that the proper Mains operating voltage is displayed.



7.5 Battery Maintenance

If the monitor has not been used or powered by AC for an extended time‡ (3 months or more) allow the battery to charge for 12 hours before use. The monitor may not power up on battery power if the battery is not sufficiently charged.

To charge the battery, connect the power cord (see below) and set the rear panel power switch ON ("|"). Check that the front panel ∿ icon is green. Allow the battery to charge for 12 hours to ensure a fully charged battery in the event that battery power is required.



The AC power line cord shipped with monitors for North America is a Hospital Grade, SJT style cord with a 120 VAC plug. All power line cords shipped with monitors for Europe are the European style with

‡. The internal battery will slowly discharge over long periods of non-use.

a 220-240 VAC plug. All other style power line cords, as required by the country of destination, are provided by the distributor of that country.

7.6 Assembly Exchanges

Disassembly should be performed by qualified service personnel only..

CAUTION

The Model 8100 contains static sensitive devices. Be sure to follow proper grounding procedures when handling the internal components to avoid damage from static discharge.

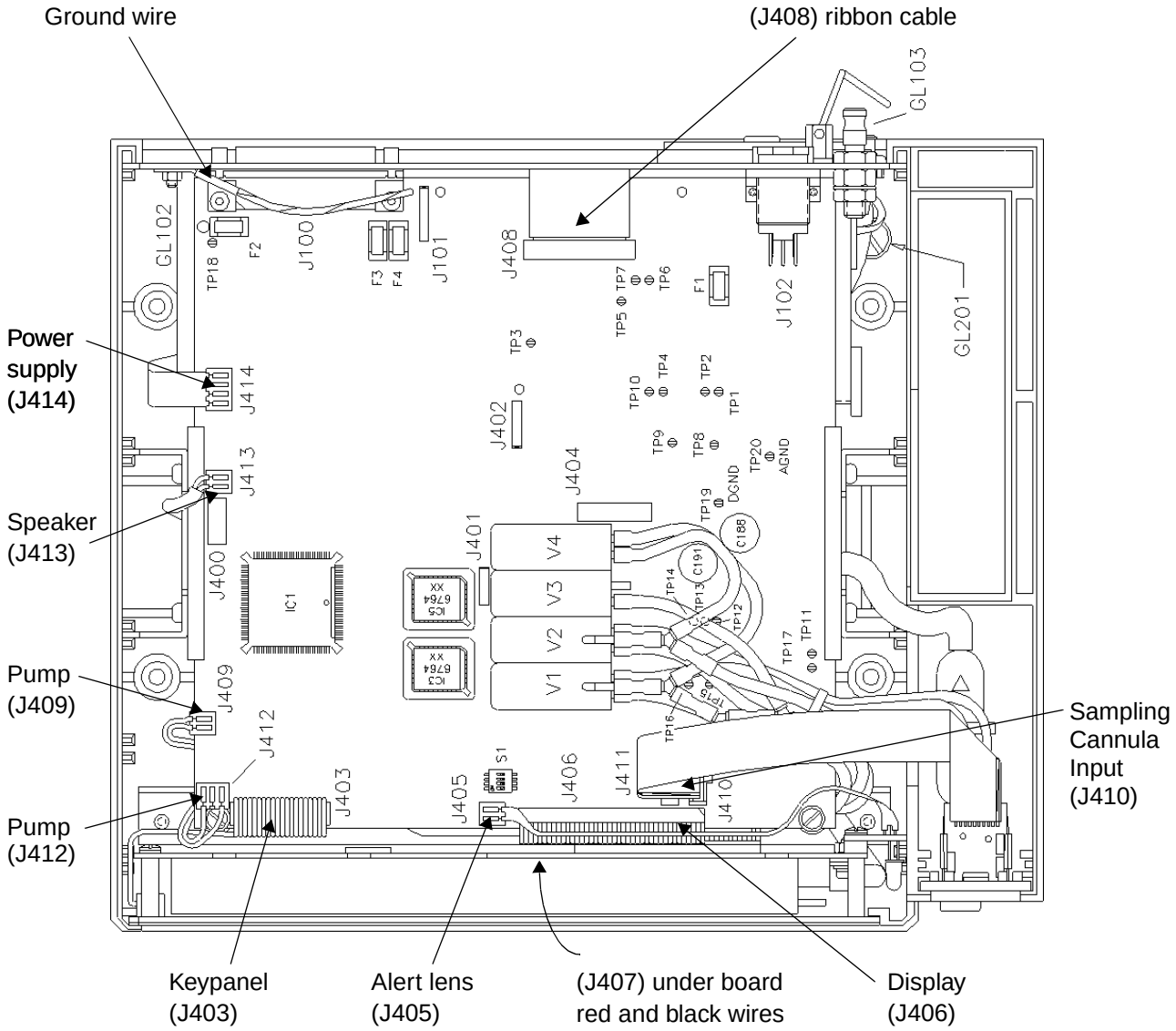
7.6.1 Internal Assemblies

1. Ensure that the monitor is OFF. Disconnect the line cord and any sensors. Turn the monitor upside down and remove the four cover screws from the bottom cover. Holding both case halves together, flip the monitor right-side up.
2. Carefully lift the top cover from the monitor (use a gentle rocking motion to lift first one side and then the other side, a little at a time). Set the red alert lens aside along with the top cover for safe keeping.
3. The separate assemblies of the monitor can now be removed.

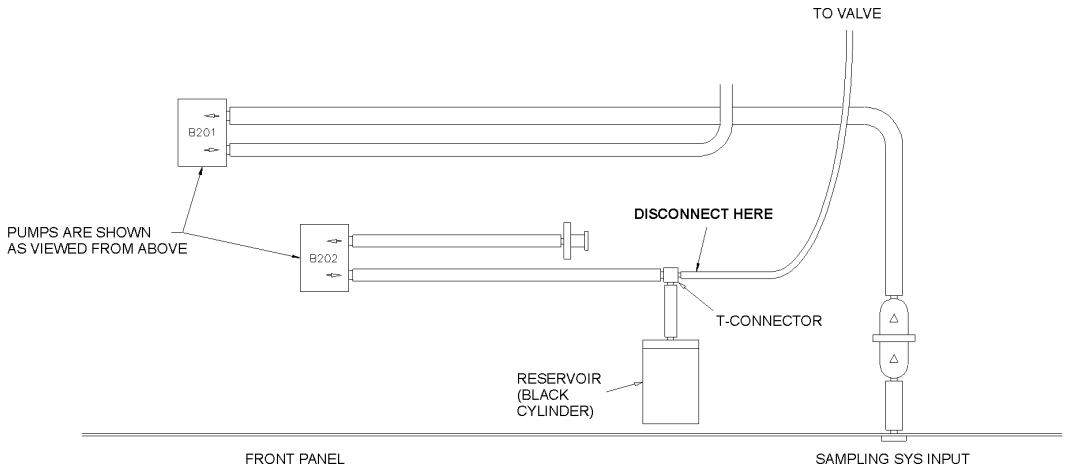
7.6.2 Main Board and CPU - Interface/Keypanel Assembly

1. Disconnect the power supply connector (J414) from the main board.
2. Remove the display/keypanel assembly and lay face down without pulling wires. Gently unplug the connector from J405, then the two ribbon cables, J403 and J406. The J407 connector under the main board (with red and black wires) is disconnected by pressing the small release button on the connector end. Pull gently out and slightly down to clear the header strip pins from above.
3. The main board is secured to the chassis via two (2) screws with tooth washers. Loosen and remove the two screws and washers. Place aside with the monitor top cover and other parts.

4. The main board is also secured to the rear panel by a nut that also secures the chassis ground connection. Remove the nut. Next disconnect J408, J409, J410, J412, and J413.



5. Only one pneumatic line must be removed to free the main board. Find the black pump reservoir under the main board. Remove either line from the T-connector on top of the reservoir.



6. Gently slide the board out, toward the front of the unit, taking care that the clear pneumatic lines clear the standoffs (lift corner slightly). Lay the main board face down.
7. Lift the plastic shield to access the nut. Remove the nut and the shield.
8. The rear panel and power supply assembly, and the battery can now be accessed.

7.6.3 Replacing the internal battery

1. Disassemble the monitor to expose the battery (see page 66, Assembly Exchanges).
2. Slide the battery bracket assembly UP from the bottom cover assembly, being careful not to disconnect the pneumatic lines. Turn the bracket over and lay it along the right rear corner of the monitor, out of the work area.
3. Disconnect J302 from the power supply board. Remove the old battery. Remove the wire harness from the old battery and install on the new one; red is positive, black is negative. Place the new battery in the battery bracket. Connect the harness to J302 on the power supply board.
4. Replace the battery bracket.

5. Dispose of the old battery in accordance with local laws. It may be illegal to dispose of this battery into the municipal waste stream. Never dispose of batteries in a fire.

7.6.4 Reassembling the monitor

1. Check that all pneumatic lines are still connected and the speaker assembly is between posts, face down on the unshielded grill. When properly in place, the power supply board will contact the foam and hold the speaker in place.
2. Replace the plastic shield and the nut.
3. Turn the main board face up, place between guides, and slide to the rear of the unit. LIft corner of board slightly to allow the pneumatic lines to clear the standoff. Reconnect pump reservoir.

4. Reconnect J408, J409, 410, J412, J413 and the chassis ground wire. Resecure the main board with two screws.
5. LIft the display/keypanel assembly. Reconnect the J407 black and red connector until it “clicks”. Reconnect J403 and J406 ribbon connectors. Slide the assembly into the bottom cover. Reconnect J405.
6. Replace the red alert lens. Reconnect the power supply connector (J414) to the main board.
7. Replace the top cover. Holding both halves together, turn the monitor upside-down and replace the four cover screws.

7.7 Software Update Instructions

The following procedure is for updating the monitor’s software from a supplied *CO_2SMO Plus!* Software Update Kit using an IBM-compatible computer.

7.7.1 Equipment Required

1. IBM-compatible computer with an unused serial port (COM1 or COM2)
2. Serial communications cable (Cat. No. 600073)
3. Update diskette PN: 6764-57-XX and/or 6895-57-XX (XX = new firmware version)
4. A reply card may be supplied by Novametrix in order to update records. Please fill out the information and place it in the mail.

7.7.2 Setup

1. Connect the serial cable to the rear panel 25 pin connector on the *CO_2SMO Plus!* (see FIG. A).
2. Connect the other end of the cable to the computer’s COM (serial) port**. The update software allows use of either COM1 or COM2. When connecting the cable be sure to record which COM port is used, the program will prompt the user for this information before updating the software.

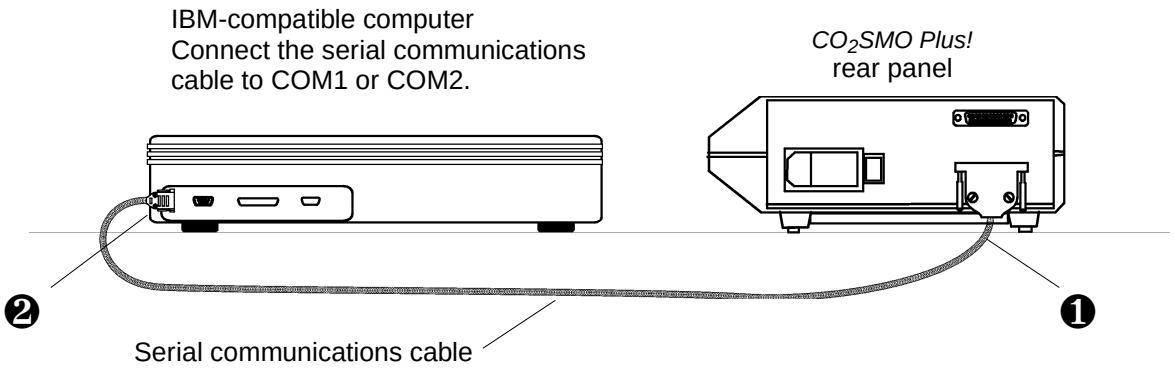


FIG. A

**. The location and availability of the COM ports (COM1, COM2) will vary from computer to computer. Refer to the computer’s documentation for more information. The update software can only communicate with the *CO_2SMO Plus!* through either COM1 or COM2.

3. Turn the *CO_2SMO Plus!* on. From the main menu, press and hold the SETUP key until the CONFIGURATION screen appears. Check that the COM1 is set to NOVACOM3, or use the NEXT and arrow keys to select it.

7.7.3 Procedure

1. Insert the update diskette into the computer's floppy drive (typically drive A).
2. **From DOS:** Type A: ↵ (where A is the drive letter where the update diskette is loaded). At the "A:" prompt type **UPDATE** then press ↵ .

   From Windows 3.x: Boot to DOS and follow the DOS instruction above.

   From Windows 95: Select Start, Run, then type A:update ↵ (where A is the drive letter where the update diskette is loaded).
3. Follow the install program screen instructions. Verify that the firmware version shown on the computer screen is correct, then press any key to continue.
4. When the following prompt appears:

```
Select the PC's COM port the instrument is connected to
from the following choices:
    1-COM1
    2-COM2
    any other key - exit
```

   Press the 1 key if the serial communications cable is connected to COM1 on the PC.
   Press the 2 key if the serial communications cable is connected to COM2 on the PC.
   If you are not sure of the process, press any other key and call service or the Novametrix Service Department at 1-800-243-3444; in Connecticut call collect (203) 265-7701.
5. When the download starts, the *CO_2SMO Plus!* screen will go blank and the following message will appear on the computer screen.

```
Validating File
```

   then,

```
UPDATING FIRMWARE, DO NOT INTERRUPT. PERCENT DONE: xx%
```

   The "xx" will count up from 0% through 100% as the update is completed.
6. The procedure is complete when the computer displays:

```
***PROGRAM COMPLETE***

F1-exit          Esc-back
```

7. Press F1 to exit the update program.

8. Check that the *CO_2SMO Plus!* restarts and returns to normal operation. If not, perform the update procedure again or call the Novametrix Service Department at 1-800-243-3444; in Connecticut call collect (203) 265-7701.
9. Remove the serial communications cable from the PC and the *CO_2SMO Plus!*. Record the serial number from the *CO_2SMO Plus!* on the reply card. Fill in the remaining information and return the postage paid card to Novametrix.

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Section 8 Specifications

8.1 General

Specifications for the Novametrix *CO_2SMO Plus!* Monitor, Model 8100, are listed for informational purposes only, and are subject to change without notice.

8.2 Capnograph

- Principle of Operation: Non-Dispersive Infrared (NDIR) absorption, dual wavelength ratiometric-single beam optics
- Sensor Type: “Mainstream” (no gas sample drawn from breathing circuit)
- Initialization Time: Capnogram in 15 seconds, full specifications in 60 seconds.
- Response Time: Less than 60 ms
- N_2O/O_2, Air, Heliox, O_2 > 60%, Anesthetic Agent Compensation: Operator selectable
- Barometric Pressure Compensation: Automatic (range 400-800 mmHg)
- CAPNOSTAT CO_2 Sensor and Airway Adapter:
  Weight: 18 g without cable
  Sensor Size: 1.30” x 1.67” x .85” inches (3.3 x 4.2 x 2.2 cm), 8 foot cable (2.44 m)
  Construction: Durable high performance plastic, ultra-flexible cable
  Shock Resistant: Sensor will withstand a 6 foot drop to a tile floor
- Airway Adapter: Single Patient Use or reusable, less than 5 cc deadspace, Neonatal less than 0.5 cc deadspace, meets ANSI Z-79
- End Tidal CO_2:
  Range: 0-150 mmHg, 0-19.7 % or 0-20 kPa at 760 mmHg Pb
  Accuracy: ± 2 mmHg for 0-40 mmHg, ± 5% of reading for 41-70 mmHg, ± 8% of reading for 71-150 mmHg
  Display Resolution: 0-50 mmHg scale, 0-75 mmHg scale, 0-100 mmHg scale, 0-150 mmHg scale.
- Respiratory Rate:
  Range: 0-150[1] breaths/min
  Accuracy: ± 1 breath/min

1. Range 0-70 when used with sampling airway adapter.

8.3 Pulse Oximeter

- Oxygen Saturation
  Range: 0-100%
  Accuracy: ± 2% for 80-100% (1 standard deviation or approximately 68% of readings are within the accuracy claim), unspecified for 0-79%
  Display Resolution: 1%
  Averaging Time: Menu selectable 2 or 8 seconds
- Pulse Rate:
  Range: 30-250 beats per minute
  Accuracy: ± 1% of full scale
  Display Resolution: 1 beat per minute
  Averaging Time: fixed at 8 seconds

8.4 Flow Sensor Specifications

- **Flow Range (L/min):**
  Neonatal Flow - 0.25 to 25
  Neonatal CO_2/Flow - 0.25 to 25
  Pediatric CO_2/Flow - 0.5 to 120
  Pediatric/Adult Flow - 2 to 180
  Pediatric/Adult CO_2/Flow - 2 to 180
- **Flow Accuracy:**
  Neonatal Flow - Greater of ± 3% reading or .125 L/min
  Neonatal CO_2/Flow - Greater of ± 3% reading or .125 L/min
  Pediatric CO_2/Flow - Greater of ± 3% reading or .25 L/min
  Pediatric/Adult Flow - Greater of ± 3% reading or .5 L/min
  Pediatric/Adult CO_2/Flow - Greater of ± 3% reading or .5 L/min
- **Minute Volume Range (L/min):**
  Neonatal Flow 0.1 to 15
  Neonatal CO_2/Flow 0.1 to 15
  Pediatric CO_2/Flow 0.5 to 30
  Pediatric/Adult Flow 2 to 60
  Pediatric/Adult CO_2/Flow 2 to 60
- **Tidal Volume Range (ml):**
  Neonatal Flow - 1 to 100
  Neonatal CO_2/Flow - 1 to 100
  Pediatric CO_2/Flow - 30 to 400
  Pediatric/Adult Flow - 200 to 3000
  Pediatric/Adult CO_2/Flow - 200 to 3000
- **Airway Pressure Range (cm H_2O):**
  Neonatal Flow -120 to 120
  Neonatal CO_2/Flow -120 to 120
  Pediatric CO_2/Flow -120 to 120
  Pediatric/Adult Flow -120 to 120
  Pediatric/Adult CO_2/Flow -120 to 120
- **Added Dead Space (ml):**
  Neonatal Flow - less than 1 ml
  Neonatal CO_2/Flow - less than 1 ml
  Pediatric CO_2/Flow - less than 4 ml
  Pediatric/Adult Flow - 6.5
  Pediatric/Adult CO_2/Flow - 8

8.5 Monitor Specifications

- Classification (IEC601-1): Class I/internal power source, type BF, continuous operating mode
- Operating Environment: 50-104° F (10-40° C), 0-90% relative humidity (non-condensing)
- Size: Height 3.3 in. (8.38 cm), Width 9 in. (22.86 cm), Depth 8 in. (20.32 cm)
- Weight: 8 pounds (3.63 kg)
- Power: 100-120/200-240 VAC, 50-60 Hz, 40VA
- Fuse Rating: 100-120/200-240 VAC, 0.5 A 250 V Slo-Blo (x2); 200-240 VAC, T 250 mA/250 V (x2)
- Battery: Sealed lead-acid gel-cell, not externally removable, rechargeable, 2 hour life on full charge (on-screen life indicator), 12 hours recharge time, non-standard, 178mm x 34mm x 64mm (L x W x H).
- Display: 1.5 x 5 inch (3.81 x 12.7 cm) Cold Cathode Display (CCD)
- Electromagnetic Emissions: Conforms to EMC Directive 89/336/EEC, CISPR Class A. Tested to EN55011 (1991) and CISPR11 (1990).
- Electromagnetic Immunity: Conforms to EMC Directive 89/336/EEC, EN50082-1 (1992). Tested to IEC801-3 (1984) Radiated Immunity. Conforms to Medical Device Directive 93/42/EEC EN60601-1 (1992). Tested to IEC801-2 (1991) ESD, IEC801-4 (1988) EFT, and IEC1000-4-5 (1995) Surge Immunity.

8.6 Additional Features

- Audible SpO_2 Trend Feature: Pitch of Pulse Rate “beep” tracks the SpO_2 value, user selectable volume.
- Alert Limits: Automatic or menu selected high and low limits for $ETCO_2$, Respiratory Rate, SpO_2 and Pulse Rate. No respiration alert selectable between 20 and 60 seconds. Visible alert is immediate; audible alert can be delayed until 10 seconds after set limit is exceeded.
- 2-Minute Silence: When key is pressed, audible alerts are deactivated for two minutes. Indicated by illuminated (2 minute LED)
- Audio Off: Press and hold key for 3 seconds to deactivate audible alerts. Indicated by flashing (Audio Off LED)
- Trend Memory: 24 hour trend memory capacity, battery backed. On-screen trends for VCO_2, mechanical and spontaneous alveolar minute ventilation, mechanical and spontaneous alveolar tidal volume, and airway deadspace. Other parameters are stored internally and can be downloaded to a PC.
- Digital Data Output: Serial (RS232), connect only to IEC601 approved devices.
- Sampling System: Standard. Allows gas sampling of non-intubated patients
- Internal Real Time Clock
- Red Alert Bar

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Section 9 *Accessories*

CO_2SMO Plus! (Model 8100) Respiratory Profile Monitor

Catalog No.	Description
6758-00	*CO_2SMO Plus!* **Respiratory Profile Monitor (Model 8100)** with CAPNOSTAT CO_2 Sensor (Cat. No. 7167), *Series 3* pediatric/adult combined CO_2/flow sensor (Cat. No. 6719), choice of Oxy*Snap* Sensor, and Oxy*Snap* extension cable (8853-00).

CAPNOSTAT MAINSTREAM CO_2 SENSOR and ACCESSORIES

7167-00	**CAPNOSTAT CO_2 Sensor**
6934-00	**Cable Management Straps for use with CAPNOSTAT CO_2 Sensor** (5 per box)
6942-00	*CO_2SMO Plus!* for Windows includes software, interface cable (600073), User's Manual and Respiratory Monitoring tutorial.

COMBINED CO_2/FLOW SENSORS (SINGLE PATIENT USE)

The following are airway adapters (for the CAPNOSTAT CO_2 sensor) combined with a flow sensor.

6719-00	***Series 3*** **Pediatric/Adult Combined CO_2/Flow Sensor** (10 per box)
6716-00	***Series 3*** **Pediatric Combined CO_2/Flow Sensor** (10 per box)
6720-00	***Series 3*** **Neonatal/Pediatric Combined CO_2/Flow Sensor** (10 per box)

CO_2 AIRWAY ADAPTERS (REUSABLE)

For monitoring CO_2 with the CAPNOSTAT CO_2 sensor.

7007-01	**Pediatric/Adult Airway Adapters** (1 per box)
7007-50	**Pediatric/Adult Airway Adapters** (5 per box)
7007-00	**Pediatric/Adult Airway Adapters** (10 per box)
7053-01	**Neonatal/Pediatric Airway Adapters** (1 per box)
7053-50	**Neonatal/Pediatric Airway Adapters** (5 per box)
7053-00	**Neonatal/Pediatric Airway Adapters** (10 per box)
5953-00	**Neonatal Airway Adapters for Low Deadspace ET Tubes** (10 per box)

CO_2 AIRWAY ADAPTERS (SINGLE PATIENT USE)

For monitoring CO_2 with the CAPNOSTAT CO_2 sensor.

6063-00	**Pediatric/Adult Single Patient Use Airway Adapters** (10 per box)
6063-25	**Pediatric/Adult Single Patient Use Airway Adapters** (25 per box)
6421-00	**Pediatric/Adult Single Patient Use Airway Adapters with mouthpiece** (10 per box)
6421-25	**Pediatric/Adult Single Patient Use Airway Adapters with mouthpiece** (25 per box)
6312-00	**Neonatal/Pediatric Single Patient Use Airway Adapters** (10 per box)
6312-25	**Neonatal/Pediatric Single Patient Use Airway Adapters** (25 per box)

Catalog No.	Description
	SAMPLING ADAPTER and ACCESSORIES
5843-01	**Sampling Adapters with tubing,** reuseable (1 per box)
5843-50	**Sampling Adapters with tubing,** reuseable (5 per box)
5843-00	**Sampling Adapters with tubing,** reuseable (10 per box)
8781-00	**Nasal CO_2 Sampling Cannula—Adult**, Single Patient Use (10 per box)
8780-00	**Nasal CO_2 Sampling Cannula—Pediatric**, Single Patient Use (10 per box)
8906-00	**Nasal CO_2 Sampling and O_2 Delivery Cannula—Adult,** Single Patient Use (10 per box)
8907-00	**Nasal CO_2 Sampling and O_2 Delivery Cannula—Pediatric,** Single Patient Use (10/box)
8908-00	**Nafion® Dehumidification Tubing** (10 per box)
5816-34	**Nasal CO_2 Sampling Starter Kit** Includes 1 each: Sampling Airway Adapter with tubing (5843), Nasal CO_2 Sampling Cannula—Adult (8781), & Dehumidification Tubing (8908)

FLOW SENSORS

	For monitoring airway flow without an adapter for the CAPNOSTAT CO_2 sensor.
6717-00	***Series 3*** **Pediatric/Adult Flow Sensor** (10 per box)
6718-00	***Series 3*** **Neonatal Flow Sensor** (10 per box)

SpO_2 SENSORS and ACCESSORIES

	REUSABLE Oxy*Snap*™ SpO_2 SENSORS AND CABLES
8793-00	**Oxy*Snap* Y-Sensor** (use with **Oxy*Snap*** Extension Cable)
8744-00	**Oxy*Snap* Finger Sensor** (use with **Oxy*Snap*** Extension Cable)
8853-00	**Oxy*Snap* Extension Cable**, 8 ft. (use with **Oxy*Snap*** sensors)
8898-00	**Oxy*Snap* Long Extension Cable**, 12 ft. (use with **Oxy*Snap*** sensors)
	OTHER SpO_2 SENSORS and CABLES
8776-00	**SuperBright™ Finger Sensor** (10 ft. sensor cable)
8791-00	**SuperBright™ Y-Sensor** (10 ft. sensor cable)
	Y-STRIP TAPES, FOAM WRAPS and EAR CLIPS (for use with the Y-Sensor)
8828-00	**20mm Wrap Style Y-Strip Taping System** (100 per box) Use on neonatal foot and hand, or on pediatric toe or finger 20mm tapes use Blue color-coded liners
8829-00	**25mm Wrap Style Y-Strip Taping System** (100 per box) Use on neonatal foot and hand 25mm tapes use Green color-coded liners
8831-00	**20mm Finger Style Y-Strip Taping System** (100 per box) Use on pediatric finger or on small adult finger 20mm tapes use Blue color-coded liners
8832-00	**25mm Finger Style Y-Strip Taping System** (100 per box) Use on adult finger 25mm tapes use Green color-coded liners
8836-00	**Non-Adhesive Foam Wraps** (25 per box)
8943-00	**Neonatal/Pediatric Non-Adhesive Foam Wraps** (25 per box)
6929-00	**Adhesive Foam Wraps,** Large (25 per box)
6968-00	**Adhesive Foam Wraps,** Small (25 per box)
6131-50	**Ear Clips** For use with Y-Sensor (5 per box)

Catalog No.	Description
6131-25	**Ear Clips** For use with Y-Sensor (25 per box)
8700-00	**Adhesive Dots** (200 per box)

EXTENSION CABLES FOR SpO_2 SENSORS

4941-00	**Saturation Sensor Extension Cable with Hypertronics Connector**—4 feet
4942-00	**Saturation Sensor Extension Cable with Hypertronics Connector**—6 feet
4943-00	**Saturation Sensor Extension Cable with Hypertronics Connector**—10 feet
5266-00	**Saturation Sensor Extension Cable with Hypertronics Connector**—25 feet
6147-00	**Saturation Sensor Extension Cable with Hypertronics Connector**—50 feet

MISCELLANEOUS

9685-32	**Instruction Card**, Patient/Sensor Selection Table, laminated, 6” x 2 3/4”
280022	**Beaded Metal Chain** for use with Instruction Card
7104-10	**Side Pouch** for accessories (included with monitor)
600026	**Power Cord** (included with monitor)
600073	**Cable Serial Output to Personal Computer** (with 9-pin connector)
600081	**TrendCare Interface Cable**
600082	**Dual Port Serial Cable** (required when connecting to ABG monitors)
600083	**IRMA Interface Cable**
600084	**VIA Monitor Interface Cable**
550034	**Cable Serial Output to HP VueLink Interface Adapter**
8935-25	**15 mm Male/Female Adapter** (package of 25) Use to connect Novametrix neonatal airway adapters to neonatal flow sensors.
8937-25	**15 mm Male/Female Adapter, Low Deadspace** (package of 25) Use to connect Novametrix neonatal airway adapters to low deadspace ET tube connectors.
6758-90	**Service Manual** *CO_2SMO Plus!* (Model 8100) Respiratory Profile Monitor

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Section 10 *Parts Lists*

6758-00 06 CO_2SMO Plus! Monitor, Model 8100

LINE	PART NO	REV	QPA	DESCRIPTION
0001	1003-32	03	1	LABEL, SERIAL NUMBER, 3.000 X .5000
0002	1217-32	04	1	REPAIR LABEL
0003	4470-32	00	1	LABEL, CAUTION GROUNDING
0004	5816-34	01	1	STARTER KIT, SAMPLING SYSTEM
0005	6719-01	01	1	SERIES 3 PED/ADULT COMB CO2/FLOW SNSR ASSY
0006	6758-01	02	1	MAIN ASSY
0007	6758-43	00	0	DATA SHEET
0008	6758-09	01	0	OVERALL WIRING DIAGRAM
0009	6758-23	01	1	USER'S MANUAL
0010	6758-40	00	0	DESIGN DOCUMENTATION
0011	6758-70	00	0	INSPECTION PROCEDURE, QA
0012	6758-75	03	0	DEVICE MASTER RECORD
0013	6765-01	02	1	TOP COVER ASSY
0014	6758-04	00	0	TEST PROCEDURE, SYSTEM
0015	9621-16	02	1	LENS, ALERT
0016	7104-10	00	1	SIDE POUCH, ACCESSORY
0017	6642-32	00	1	INSTRUCTION SHEET, BATTERY CHARGING
0020	286205		0	6-32 X 3/4 S.B.H. CAD PLATED
0021	315032		1	LABEL,"120 VAC" 10 X 20 MM BLK LETTERS,YEL BACK
0022	600026		1	LINE CORD, AC, 7 1/2 FT, HOSP GR PLUG-BUS MAC
0029	9685-32	00	1	INSTRUCTION CARD, LAMINATED, 6 X 2 3/4
0030	280022	00	1	BEADED METAL CHAIN FOR LAMINATED CARD

6758-01 02 Main Assy

LINE	PART NO	REV	QPA	DESCRIPTION
0001	2731-01	04	1	MAIN BOARD ASSY
0002	5714-01	02	1	BATTERY HARNESS ASSY
0003	5815-01	01	1	SPEAKER ASSY
0004	5842-01	02	1	INPUT TUBING ASSY
0005	6660-01	01	1	FRONT PANEL ASSY
0006	6692-01	01	1	REAR PANEL ASSY
0007	6693-01	02	1	FLOW CONNECTOR ASSY
0008	6699-01	00	1	CHASSIS ASSY

LINE	PART NO	REV	QPA	DESCRIPTION
0010	6868-01	00	1	BOTTOM COVER ASSY
0012	8921-10	00	1	DUAL TUBING, 96 IN. LONG, FLOW SENSOR
0015	250056		1	FILTER, IN-LINE, 3 MICRON
0017	250134		5	FITTING, Y, FOR 1/16 ID TUBING, WHITE, NYLON
0018	250143		1	FITTING, REDUCING ELBOW, 3/32-1/16 ID, POLYPROPELENE
0019	250144		1	FITTING, TEE, FOR 3/32 TUBING, POLYPROPLENE
0020	250161		1	RESERVOIR, POLYCARBONATE, BLACK
0021	281500		0	NUT, HEX, NO. 4-40, STEEL, CADMIUM PLATE
0022	284204		0	#4-40 X 1/2 SLOTTED BINDING HEAD
0024	286215		0	SCREW, 6-32 X 3/8 S.B.H.
0025	286220		0	SCREW, 6-32 X 3/16, SLOTTED BINDING HEAD
0026	400024		1	BATTERY, 12V DC, 2.3 AMP HOUR, LEAD ACID
0027	608114		0	TUBING, TYGON, 3/32 IN. ID X 7/32 IN. OD
0028	280189		2	STANDOFF, 5/16 DIA X 2 1/8 LONG, 4-40 THD, NY
0029	608001		0	CABLE TIE, .094 X 3.62L, SELF-LKG, 1/16 TO 5/
0030	608117		2	U-CLIP, WIRE ROUTER, .25 DIA BUNDLE, ADHESIVE
0032	285000		0	LOCK WASHER, NO. 4, INTERNAL TOOTH, STEEL

6765-01 02 Top Cover Assy

LINE	PART NO	REV	QPA	DESCRIPTION
0001	6427-32	01	1	WARNING LABEL, EXPLOSION HAZARD
0002	5828-32	02	1	LABEL, ISOLATION
0003	5862-10	00	1	SHIELD, MYLAR, TOP COVER
0004	6765-32	00	1	INSTRUCTIONS LABEL, TOP COVER
0005	6867-13	00	1	TOP COVER, PAINTING/SHIELDING
0006	161100		0	TAPE, FOAM, 3/4W X .312T, BLK, CL CELL NEOPRENE

6868-01 00 Bottom Cover Assy

LINE	PART NO	REV	QPA	DESCRIPTION
0002	5409-32	00	1	LABEL, WARNING, POLE MOUNT
0003	6868-11	00	1	BOTTOM COVER MODIFICATION
0005	5826-10	01	4	FOOT PAD, BOTTOM COVER
0006	315052		1	LABEL, EARTHING SYMBOL
0007	5760-16	00	2	LEFT FOOT, WHITE, KICKSTAND
0008	5761-16	00	2	RIGHT FOOT, WHITE, KICKSTAND
0009	4727-10	04	1	KICKSTAND, BEDRAIL
0010	284261		0	SCREW, 4-40 X 5/8 L, PHILLIPS, 82 DEG FLT HD
0011	161064		0	TAPE, 3/4 X 60 YDS, CLEAR, DOUBLE-SIDED ADHESIVE
0012	5405-10	00	1	SHIELD, BATTERY
0013	284262		0	SCREW, 4-40 X 7/8 L, SLOTTED, FLAT, HD, STEEL
0014	281519		0	NUT, HEX, 1/4-32UNEF-2B, STAINLESS STEEL
0015	5835-10	01	1	FEMALE LUER W 1/8 BARB, PANEL MOUNT

LINE	PART NO	REV	QPA	DESCRIPTION
0017	5849-10	00	1	BRACKET, SUPPORT
0019	284264		0	SCREW, 4-40 X 1/4 L, SLOTTED 82 DEG FLT HEAD
0020	161007		0	ADHESIVE, 414, HIGH STRENGTH, COLOR: CLEAR
0022	161068		0	ADHESIVE, 290, FAST-SETTING, LOW VISCOSITY

6660-01 01 Front Panel Assy

LINE	PART NO	REV	QPA	DESCRIPTION
0001	2473-01	01	1	ALERT BOARD ASSY
0002	5720-01	00	1	DISPLAY ASSY
0003	6660-27	02	1	MEMBRANE KEYPANEL
0006	280033		0	SPACER #4 X 1/8 CLEARANCE
0007	280187		0	STANDOFF, .187 DIA X 5/8 L, 4-40 F/F THD
0008	284200		0	#4-40 X 1/4 SLOTTED BINDING HEAD STEEL
0009	284204		0	#4-40 X 1/2 SLOTTED BINDING HEAD STEEL
0010	285000		0	LOCK WASHER, NO. 4, INTERNAL TOOTH, STEEL

6692-01 01 Rear Panel Assy

LINE	PART NO	REV	QPA	DESCRIPTION
0001	2726-01	03	1	POWER SUPPLY BD ASSY
0002	2732-01	00	1	ETCO2 INPUT BOARD ASSY
0003	5812-10	01	2	SPACER, SUPPORT
0004	5820-01	01	1	GROUND WIRE ASSY, 5 1/2 IN. L
0005	6497-01	01	1	GROUND WIRE ASSY, POWER ENTRY MODULE
0006	6498-01	01	1	POWER CABLE ASSY, REAR PANEL
0007	6549-01	01	1	GROUND WIRE ASSY, 5 1/2 IN. L
0008	6692-17	00	1	REAR PANEL SUBASSY
0009	6870-10	00	1	INSULATING SHIELD, POWER SUPPLY
0015	161008		0	ADHESIVE, 242, THREADLOCKER, MED STR, BLUE
0016	180036		1	FERRITE, SPLIT, 131 OHMS @100MHZ, RND CABLE
0017	210149		1	POWER ENTRY MODULE, SEL FUSE, ON/OFF SW & RFI
0018	216059		1	CONNECTOR, PLUG, POTENTIAL COMPENSATION
0019	250080		1	FITTING, LOCK RING, MALE QUICK DISCONNECT
0020	250081		1	FITTING, 1/4-28 LOCK NUT, NYLON, WHITE
0021	250082		1	FITTING, QUICK DISCONNECT FEMALE LUER
0022	280188		0	STANDOFF, 3/8 DIA X 3/8 L, 6-32 THD THRU
0023	281501		0	NUT, HEX, NO. 6-32, STEEL
0024	281509		0	NUT, HEX, NO. 2-56, STEEL
0025	285001		0	LOCK WASHER, NO. 6, INTERNAL TOOTH, STEEL
0026	285005		0	FLAT WASHER, NO. 8, STEEL, CAD PL
0027	285012		0	LOCK WASHER, NO. 2, INTERNAL TOOTH, STEEL
0028	285013		0	NYL WASH, #4 NATURAL COLOR, .115 ID, .281 OD
0029	286219		0	

LINE	PART NO	REV	QPA	DESCRIPTION
0030	515023		2	FUSE, 1/2A, 250V, SLO-BLO
0031	608033		1	WIRE CLIP & BUSHING SET, LINECORD RETAINER
0032	161092		0	ADHESIVE, 262, THREADLOCKER, HIGH STRENGTH
0033	281500		0	NUT, HEX, NO. 4-40, STEEL, CADMIUM PLATE
0034	285000		0	LOCK WASHER, NO. 4, INTERNAL TOOTH, STEEL
0035	285009		0	#4 WASHER FLAT STL CAD., .125 ID X .250 OD

6693-01 02 Flow Connector Assy

LINE	PART NO	REV	QPA	DESCRIPTION
0001	2733-01	03	1	DECODER BOARD ASSY, FLOW CONNECTOR
0002	6643-16	00	1	PNEUMATIC SEAL, FLOW CONNECTOR
0003	6652-16	00	1	PNEUMATIC CONNECTOR, RECEPTACLE, PANEL MOUNT
0004	6784-16	00	1	SUPPORT BLOCK, FLOW CONNECTOR
0005	6939-10	00	0	BONDING SOLUTION, ABS
0006	8921-10	00	0	DUAL TUBING, 96 IN. LONG, FLOW SENSOR
0010	160038		0	SOLVENT, 50% CYCLOHEXANONE & 50% TETRAHYDROFUR

6699-01 00 Chassis Assy

LINE	PART NO	REV	QPA	DESCRIPTION
0001	5886-10	00	2	BRACKET, PUMP
0002	5920-01	02	1	SAMPLING PUMP ASSY
0003	6699-10	00	1	CHASSIS
0004	6762-01	01	1	PURGE PUMP ASSY
0008	140002		2	CARD GUIDE, 2.5" L, SNAP-IN, NYLON, WHITE
0009	161067		0	TAPE, CL CELL, POLYCHLOROPRENE, .47(12)W X .0
0010	280192		0	GROMMET, RIBBED, ISODAMP, GRAY COLOR, .062 THK
0011	6885-16	00	4	FERRULE, PUMP MOUNTING
0012	281500		0	NUT, HEX, NO. 4-40, STEEL
0013	284202		0	#4-40 X 5/8 SLOTTED BINDING HEAD STEEL
0014	285000		0	LOCK WASHER, NO. 4, INTERNAL TOOTH, STEEL
0015	285045		0	WASHER, .375 DIA X .125 ID X .040 THK, NYLON

2731-01 04 Main Board Assy

PART NO	REV	QPA	DESCRIPTION
2731-03	04	0	SCHEMATIC, MAIN BOARD
2731-04	00	0	TEST PROCEDURE, MAIN BOARD
2731-17	04	1	MAIN BOARD SUBASSY
487110		1	IC, 1220A-015A-3S, PRESSURE XDCR, ABSOLUTE
487122		1	IC, SLP004DD4, L PRESS SNSR, 4 IN. H20, 6 PIN
6948-07	03	1	PROGRAM SET, FLASH EPROM W/ BOOT CODE & SYS

2731-17 04 Main Board Subassy

PART NO	REV	QPA	DESCRIPTION
152084		2	CAPACITOR, 470UF, 25V, 20%, AL, ELCTLYTC
152085		2	CAPACITOR, 1500UF, 16V, AL ELCTLT, RADIAL
152096		14	CAPACITOR, 220UF, 35V, 20%, ELCTLT
153045		1	CAPACITOR, .47UF, 50V, .200 SP, MONOLITHIC
153063		2	CAPACITOR, 220PF, 3KV, 20%, Z5U, CER, RADIAL
154072		15	CAPACITOR, .1UF, 50V, 10%, X7R, CER CHIP
154079		12	CAPACITOR, 10UF, 25V, 10%, TANTALUM
154081		1	CAPACITOR, 100PF, 100V, 10%, NPO
154086		3	CAPACITOR, 4.7UF, 10VDC, 20%, TANTALUM
154093		5	CAPACITOR, 68UF, 16VDC, 10%, TANTALUM
154103		7	CAPACITOR, .001UF, 50VDC, 10%, X7R
154104		171	CAPACITOR, .01UF, 50VDC, 10%, X7R
154105		7	CAPACITOR, 47PF, 50VDC, 5%, NPO
154106		5	CAPACITOR, 22PF, 50VDC, 5%, NPO
154108		6	CAPACITOR, 100PF, 50VDC, 5%
154111		9	CAPACITOR, .1UF, 16VDC, 5%, 1210 CASE
154112		17	CAPACITOR, .047UF, 16VDC, 10%, X7R
154116		11	CAPACITOR, 10UF, 35V, 10%, LOW ESR
180019		1	INDUCTOR, 100UH, 10%,
180022		6	INDUCTOR, 10UH, 10%
180029		7	INDUCTOR, 50MHZ CUT-OFF FREQUENCY
180030		21	INDUCTOR-CAP, 4700PF, 50VDC, 2A, 3 TERM
180034		4	FERRITE FILTER, 4 LIN, EMI SUPPRESSION
180035		11	FERRITE FILTER, 8 LINE, EMI SUPPRESSION
180045		3	INDUCTOR, 220UH, 20%, .53 OHMS 15% DCR
180047		3	INDUCTOR, 50 OHMS @ 100M HZ, 3A, 1206 STYLE
180048		3	EMI FILTER, W FERRITE, 3300PF, 100V, 3 TERM
210051		1	CONNECTOR, 25 PIN, RECEPTACLE, R ANGLE
211213		3	CONNECTOR, 2 PIN, POST HEADER
211327		1	CONNECTOR, 3 PIN, HEADER, STR, .1 SP, FRIC LK
211412		1	CONNECTOR, 4 PIN, HEADER, R ANGLE, PC MNT
211414		1	CONNECTOR, 4 PIN, PLUG, FRICTION LOCK
212133		1	CONNECTOR, 10 PIN, HDR, SHROUDED, STR
212501		2	CONNECTOR, 20 PIN, HEADER, DUAL ROW, STR
212529		1	CONNECTOR, 20 PIN, HEADER, STRAIGHT
215073		2	SOCKET, PLCC, 32 PIN, .05 SP, LOW PROFILE
216029		20	TEST POINT, SPRING LOADED, 475 DEG C MAXIMUM
230024		1	CRYSTAL, 32.768 KHZ, SURFACE MOUNT
230025		1	CRYSTAL, 3.6864 MHZ, SURFACE MOUNT
250146		2	VALVE, SOLENOID, 5V, 0-30 PSIG, 10 PSID MAX
250151		2	VALVE, SOLENOID, 5V, 0-30 PSIG, 10 PSID MAX
2731-02	02	1	FAB, MAIN BOARD
281211		0	SCREW, 2-56 X 1/4L, SELF TAPPING, BINDING HEAD
400042		1	INVERTER, DC TO AC INVERTER, 12VDC INPUT
470109		1	RESISTOR, 470K OHM, 1/2W, 10%

PART NO	REV	QPA	DESCRIPTION
471400		1	RESISTOR, 100M OHM, 1W, 5%, .9 PITCH
472198		1	RESISTOR, 3.3 OHM, 1/4W, 1%, CARBON
472200		1	RESISTOR, 5.6 OHM, 1/4W, 1%
472274		1	RESISTOR, 26.7 OHM, 1/4W, 1%
474008		2	RESISTOR, 470 OHM, 1/2W, 10%
474032		1	RESISTOR, 10 OHM, 1/2W, 5%, CARBON
474172		1	RESISTOR, 10 OHM, 1/8W, 1%
474194		2	RESISTOR, 2.2M OHM, 1/16W, 5%
474195		3	RESISTOR, 511K OHM, 1/16W, 1%
474197		13	RESISTOR, 49.9K OHM, 1/16W, 1%
474198		6	RESISTOR, 2.49K OHM, 1/16W, 1%
474222		12	RESISTOR, 10 OHM, 1/16W, 1%, 0603 STYLE
474223		2	RESISTOR, 49.9 OHM, 1/16W, 1%, 0603 STYLE
474224		46	RESISTOR, 100 OHM, 1/16W, 1%, 0603 STYLE
474225		12	RESISTOR, 499 OHM, 1/16W, 1%, 0603 STYLE
474227		41	RESISTOR, 1K OHM, 1/16W, 1%, 0603 STYLE
474228		3	RESISTOR, 1.21K OHM, 1/16W, 1%, 0603 STYLE
474229		5	RESISTOR, 2.05K OHM, 1/16W, 1%, 0603 STYLE
474230		5	RESISTOR, 3.32K OHM, 1/16W, 1%, 0603 STYLE
474231		7	RESISTOR, 4.99K OHM, 1/16W, 1%, 0603 STYLE
474233		114	RESISTOR, 10K OHM, 1/16W, 1%, 0603 STYLE
474234		3	RESISTOR, 20.5K OHM, 1/16W, 0603 STYLE
474235		12	RESISTOR, 24.9K OHM, 1/16W, 1%, 0603 STYLE
474236		10	RESISTOR, 33.2K OHM, 1/16W, 1%, 0603 STYLE
474238		2	RESISTOR, 37.4K OHM, 1/16W, 1%, 0603 STYLE
474239		9	RESISTOR, 75K OHM, 1/16W, 1%, 0603 STYLE
474240		56	RESISTOR, 100K OHM, 1/16W, 1%, 0603 STYLE
474241		11	RESISTOR, 150K OHM, 1/16W, 1%, 0603 STYLE
474242		12	RESISTOR, 249K OHM, 1/16W, 1%, 0603 STYLE
474243		3	RESISTOR, 324K OHM, 1/16W, 1%, 0603 STYLE
474245		12	RESISTOR, 1M OHM, 1/16W, 1%, 0603 STYLE
474247		2	RESISTOR, 10M OHM, 1/16W, 5%, 0603 STYLE
474250		1	RESISTOR, 43.2K OHM, 1/16W, 1%, 0603 STYLE
474259		4	RESISTOR, 15K OHM, 1/16W, 1%, 0603 STYLE
474260		3	RESISTOR, 121K OHM, 1/16W, 1%, O603 STYLE
474261		4	RESISTOR, 7.5K OHM, 1/16W, 1%, 0603 STYLE
474265		2	RESISTOR, 1 OHM, 1/4W, 1%, 1206 SIZE
474284		1	RESISTOR, 115 OHM, 1/16W, 1%, 0603 STYLE
474292		1	RESISTOR, 13K OHM, 1/16W, 1%, 0603 STYLE
475042		2	POTENTIOMETER, 50K OHM, 10%, TOP ADJ, M-TURN
475043		1	POTENTIOMETER, 500 OHM, 10%, TOP ADJ, M-TURN
475046		1	POTENTIOMETER, 5K OHM, 10%, MULTI-TURN
481036		1	DIODE, ZENER, 1N5366B, 39V, 5W, 5%
481046		1	DIODE, ZENER, MMSZ5236BT1, 7.5V, 500MW
481501		1	DIODE, 1N4148, SIGNAL, SILICON, HIGH SPEED
481546		10	DIODE, MMBD914L, SWITCHING
481547		7	DIODE, BAT54, HOT CARRIER SCHOTTKY

PART NO	REV	QPA	DESCRIPTION
481548		7	DIODE, EGL41B, RECTIFIER, SILICON
481549		7	DIODE, MBRS140T3, RECTIFIER
481552		1	DIODE, MBRS340T3, SCHOTTKY, 40V, 3A
481554		7	DIODE, BAV70LT1, DUAL COMMON CATHODE, 70V
481555		27	DIODE, MMBD7000LT1, DUAL SWITCHING
481557		2	DIODE, MBRS1100T3, SCHOTTKY, 1A, 100V
482551		1	LED, RED, WITH LENS
483019		6	TRANSISTOR, MMBT2907ALT1, PNP, SOT-23
484061		5	TRANSISTOR, MMBT2222ALT1, NPN, SOT-23
484062		1	TRANSISTOR, MMBT2369LT1, NPN, SOT-23
484540		1	VOLTAGE REGULATOR, LP2951CM, POSITIVE, ADJ
484541		1	VOLTAGE REGULATOR, LM317LD, +1.2V - +37V OUT
484542		1	VOLTAGE REGULATOR, MC79L05ACD, -5V OUT, 5%
484557		1	VOLTAGE REGULATOR, LT1117CST-5, POS, 3 PIN
484562		2	IC, LT1175CS8-ADJ, MICROPOWER REGULATOR, 8 P
484563		2	IC, LT1117CST, VOLTAGE RGLTR, POS, ADJ, 3 P
484565		1	IC, LT1170CQ, VOLTAGE REGLTR, 5A SWITCHING
484571		1	VOLTAGE RGLTR, LM2595S-12, 12V, 1A SW, T0263
485532		20	TRANSISTOR, 2N7002T1, N-CHAN ENHAN MODE
485540		3	TRANSISTOR, SI9955DY, MOSFET, DUAL, N-CH ENH
485541		3	TRANSISTOR, SI9947DY, MOSFET, DUAL P-CH ENH
485543		3	TRANSISTOR, SI9952DY, MOSFET, N-CH & P-CH
486037		2	IC, HM628128LFP-12, 128K X 8 BITS RAM, 32 PN
486042		1	IC, AT93C66-10SC, SERIAL 4K EEPROM, 8 PIN
486049		1	IC, MC68332GCFC20, 20M HZ, 132 PIN, PQFP
486312		1	IC, SCC2691AC1D24, UNIV ASYNCH RCVR/XMITTER
486314		3	IC, MC74HC541DW, OCTAL BUFFER/LINE DRVR-RCVR
486320		3	IC, SN74HC14D, HEX SCHMITT-TRIGGER INV
486321		2	IC, SN74HC138D, 3-LINE TO 8-LINE DECDR
486322		1	IC, SN74HC02D, QUAD 2-IN POS NOR GATE
486323		5	IC, SN74HC573DW, OCTAL D-TYPE LATCH
486324		1	IC, DG444DY, QUAD SPST CMOS ANALOG SW
486325		1	IC, MC14093BD, QUAD 2-IN SCHMITT TRIGGER
486326		1	IC, MC14013BD, DUAL D FLIP-FLOP
486332		2	IC, AD7703BR, 20-BIT A TO D CONVERTER
486337		1	IC, LT1181ACS, RS232 DUAL DRVR/RCVR, L PWR
486340		2	IC, TLC2543CDW, 12 BIT A TO D CONV, 20 PIN
486341		1	IC, DAC-8841FS, D TO A CONVERTER, 8-BIT OCTAL
486348		1	IC, MM74HC4040M, 12-STAGE BIN CNTR, 16 PIN
486785		1	IC, LP339M, QUAD VOLTAGE COMPARATOR, ULTRA-LO
486790		8	IC, TLE2022CD, DUAL OP AMPLIFIER, H SPEED, LO
486796		8	IC, TLC2272CD, DUAL OP AMP, RAIL TO RAIL
486805		5	IC, LM393M, DUAL VOLTAGE COMP, L PWR
486807		1	IC, SMP04ES, QUAD SAMPLE & HOLD AMP, 16 PIN
486808		2	IC, AD680JR, 2.5 VOLTAGE REF, L PWR, 8 PIN
486819		1	IC, AD7564BR, 12-BIT D TO A CONV, QUAD, L PWR
486821		7	IC, AD822AR, FET-IN OP AMP, L POWER, 8 PIN

PART NO	REV	QPA	DESCRIPTION
487064		4	IC, CNY17-III, PHOTON COUPLED ISOLATOR
487078		2	IC, AD712JR, DUAL BIFET OP AMPLIFIER
487094		1	IC, RTC-62423, REAL TIME CLOCK W QTZ CRYSTAL
487100		1	IC, TC1426COA, INV DUAL MOSFET DRVR, 1.2A
487103		1	IC, TC4405COA, DUAL OD FET DRVR, NON-INV, 1.5
487104		1	IC, TC4404COA, DUAL OD FET DRVR, INV, 1.5A
487108		1	IC, TL7757CD, VOLTAGE SUPERVISOR, 8 PIN, S MN
487114		1	IC, MC34119D, AUDIO AMPLIFIER, L PWR, 8 PIN,
487115		3	IC, AD620BR, INSTR AMPLIFIER, L PWR, 8 PIN
513010		1	SWITCH, SLIDE, SPDT, 4 SWITCHES, .050 SP
515082		2	FUSE W FUSEHOLDER, 1/2A, 125V, VERY FAST-ACT
515088		1	FUSE W FUSEHOLDER, 1/16A, 125V, V FAST-ACT
515089		2	FUSE W FUSEHOLDER, 1/8A, 125V, V FAST-ACT
5844-01	02	1	CONNECTOR & BRACKET ASSY, SPO2 INPUT
6756-10	00	1	TRANSFORMER, MAIN BOARD
6799-01	00	1	GROUND WIRE ASSY, 3 IN. L, MAIN BOARD

2726-17 03 Power Supply Board Subassy

PART NO	REV	QPA	DESCRIPTION
152029		1	CAPACITOR, 220UF 20%, 35V, ALUM, ELECTROLYTIC
152081		1	CAPACITOR, 6800UF, 35V, 20%, AL, ELECTROLYTIC
154072		5	CAPACITOR, .1UF, 50V, 10%, X7R, CER CHIP
180014		1	INDUCTOR, 25UH, .25 SPACING, PC MOUNT
211213		1	CONNECTOR, 2 PIN, POST HEADER
211505		1	CONNECTOR, 5 PIN, SQ POST HEADER, .156 SP
2725-02	01	1	FAB, POWER SUPPLY BOARD
280114		0	SNAP RIVET, .118-.158 THICK PANEL
470026		1	RESISTOR, 150 OHM, 1/4W, 10%, CARBON
474145		1	RESISTOR, 215 OHM, 1/8W, 1%
474151		1	RESISTOR, 37.4K OHM, 1/8W, 1%
474162		1	RESISTOR, 61.9K OHM, 1/8W, 1%
474165		1	RESISTOR, 10K OHM, 1/8W, 1%
474166		3	RESISTOR, 100K OHM, 1/8W, 1%
474167		1	RESISTOR, 2.2M OHM, 1/8W, 1%
474181		1	RESISTOR, 4.3 OHM, 1W, 5%, METAL OXIDE
474211		1	RESISTOR, 49.9K OHM, 1/8W, 1%, 1206 STYLE
474214		2	RESISTOR, 332K OHM, 1/8W, 1%, 1206 STYLE, SRF
474215		1	RESISTOR, 2.21K OHM, 1/8W, 1%, 1206 STYLE, SR
474216		1	RESISTOR, 4.99K OHM, 1/8W, 1%, 1206 STYLE, SR
474218		1	RESISTOR, 47.5K OHM, 1/8W, 1%, 1206 STYLE, SR
481044		1	DIODE, ZENER, BZX84C12LT1, 12V
481530		1	DIODE, KBU4G, 4 AMP, 400V, BRIDGE RECTIFIER
481552		3	DIODE, MBRS340T3, SCHOTTKY, 40V, 3A
484529		1	VOLTAGE REGULATOR, LM78L05ACZ, 5V, 100MA
484559		1	VOLT RGLR, LT1076CT FLOW 30, 2A, STEP DOWN

PART NO	REV	QPA	DESCRIPTION
485532		1	TRANSISTOR, 2N7002T1, N-CHAN ENHAN MODE
485535		1	TRANSISTOR, IRFD9020, P-CHANNEL, MOSFET
486805		1	IC, LM393M, DUAL VOLTAGE COMP, L PWR
515083		1	FUSE W FUSEHOLDER, 1A, 125V, V FAST-ACTING
515085		1	FUSE W FUSEHOLDER, 2A, 125V, SLO-BLO, SUBMIN
5918-10	02	1	XFMR, MAINS, PWR SPLY BD
600034		1	RIBBON CABLE ASSY, 4 PIN, 4 INCHES LONG

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Section 11 *Drawings*

Drawing	Description
6758-00	Flow, ETCO2 & SpO2 Monitor, Model 8100 - CO2SMO Plus!
6758-09	Overall Wiring Diagram, Model 8100 - CO2SMO Plus!
6758-01	Main Assembly, Model 8100 - CO2SMO Plus! (3 sheets)
2732-01	ETCO2 Input Board Assembly, Model 8100
2732-03	CO2 Interface PCB, Schematic
2733-01	Decoder Board, Flow Connector, Model 8100
2726-01	Power Supply Board
2726-03	Schematic, Power Supply Board
2731-01	Main Board Assembly, Model 8100 - CO2SMO Plus! (3 sheets)
2731-03	Schematic, Main Board, Model 8100 (10 sheets)

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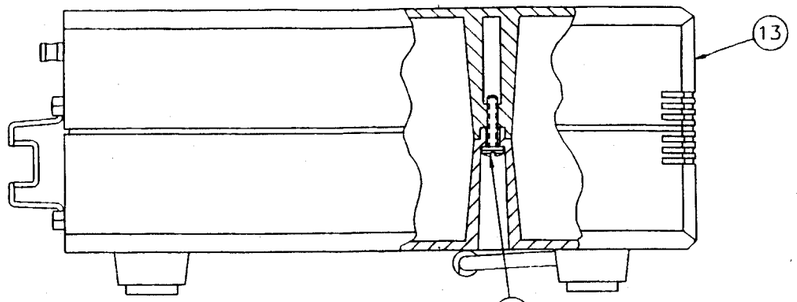

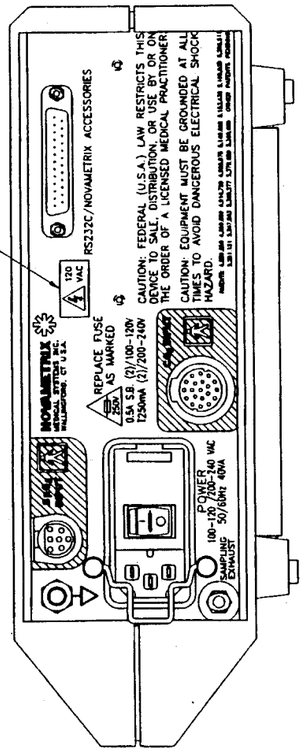

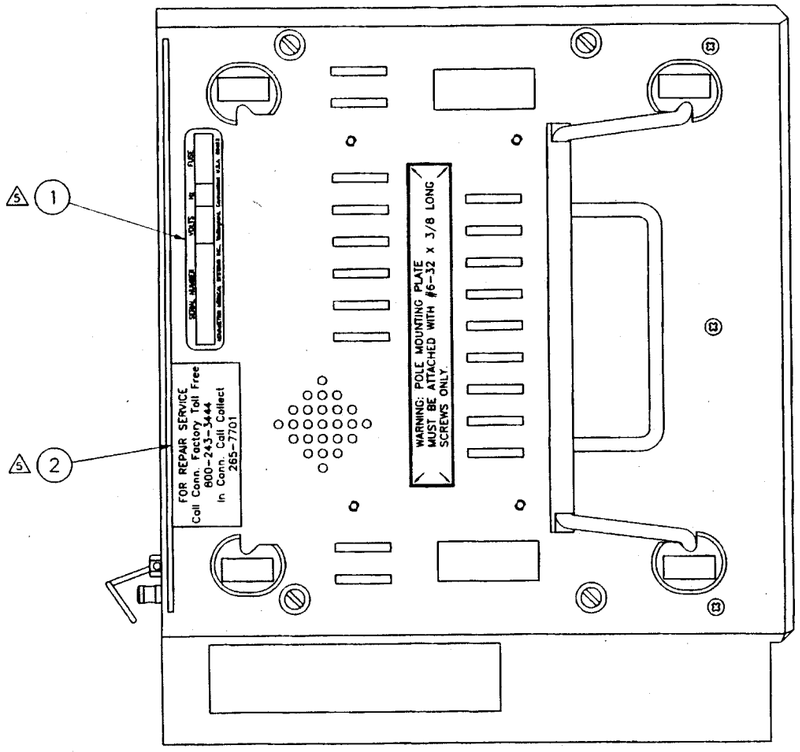

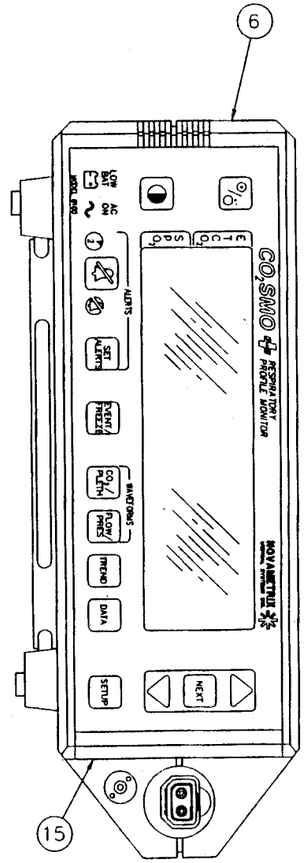

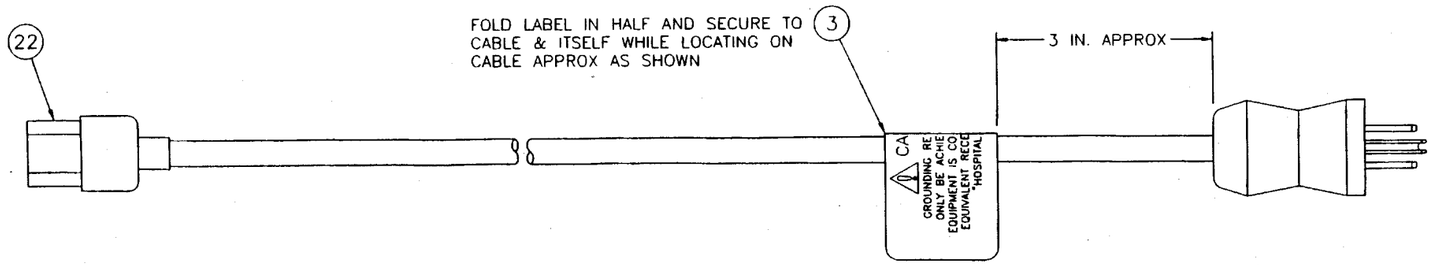
22
FOLD LABEL IN HALF AND SECURE TO CABLE & ITSELF WHILE LOCATING ON CABLE APPROX AS SHOWN
3
3 IN. APPROX
GROUNDING RE ONLY BE ACHIE EQUIPMENT IS CO EQUIVALENT RECE HOSPITAL

NOTES:

1. FOR SYSTEM TEST PROCEDURE SEE A6758-04.
2. FOR QA INSPECTION PROCEDURE SEE A6758-70.
3. FOR OVERALL WIRING DIAGRAM SEE D6758-09.
4. WIPE UNIT CLEAN WITH ISOPROPYL ALCOHOL AND LOCATE LABELS APPROX AS SHOWN.
5. INCLUDE THE FOLLOWING ITEMS WITH MONITOR:
   A. ITEM 4: SAMPLING SYSTEM STARTER KIT
   B. ITEM 5: PEDIATRIC/ADULT COMBINED CO2/FLOW SENSOR
   C. ITEM 9: USERS MANUAL
   D. ITEM 16: ACCESSORY SIDE POUCH. DO NOT ATTACH.
6. PLACE BATTERY CHARGING INSTRUCTION SHEET, ITEM 17 ON TOP OF UNIT WITH NOMENCLATURE UP PRIOR TO WRAPPING UNIT IN PLASTIC.

REV	R NO	DATE
06	N516	15Oct97
05	N514	10Oct97
04	N512	30Oct97
03	N501	29Aug97
02	N492	11Jul97
01	N462	14Apr97

DO NOT SCALE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES (mm)
BREAK ALL SHARP EDGES
TOLERANCES
DEC ± ~ (mm) ± ~
FRAC ± ~ (mm) ± ~
HOLES +.007 -.003 (mm) (+.18 -.08)
ANG ± ~
MATERIAL ~
FINISH ~

TITLE: FLOW, ETCO2 & SPO2 MONITOR, MODEL 8100 - COSMO+

NOVAMETRIX MEDICAL SYSTEMS INC. WALLINGFORD, CT U.S.A. 06492

DRAWN BL 20Nov98 | CHECKED MRL 10Apr97
MFG ENGR MJC 4/10/97 | APPROVED RHD 10Apr97
USED ON: ~

SIZE D | DRAWING NO 6758 | CODE 00 | REV 06
SCALE 1/1 | SHEET 1 OF 1

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PM101
POWER ENTRY MODULE
CONFIGURED FOR 120V AC

J104
L
PE
N
POWER INPUT
100/120V AC
50/60 Hz

S101
G
H
F101
1/2A 250V
SLO-BLO
F102
1/2A 250V
SLO-BLO
VOLTAGE
SELECTOR
(A) J305 P305
(B) J306 P306
(C) J307 P307
(D) J308 P308
BRN
BRN
BLU
BLU
P301 J301
T301
POWER SUPPLY BD
D2726-03
F302 1A
125V
V FAST-ACT
J302 P302
B5714-01
P306 J306
P305 J305
BT301
12V DC
F301
2A
125V
SLO-BLO
E302
(GND)
REAR
PANEL
ISOLATION BARRIER
P414
J414
FRONT PANEL
C6660-01
EMI/RFI SHIELDING
MEMBRANE
KEYPANEL
D6660-27
GRN/YEL
GL101
(INTERIOR)
GL201
BOTTOM COVER
GL103
(EXTERIOR)
GL102
(INTERIOR)
SAMPLING
SYS PUMP
B201
B5920-01
P409 J409
PURGE PUMP
B202
B6762-01
P412 J412
LS201
B5815-01
P413 J413
J403 P403
J405 P405
J407 P407
J406 P406
J410 P410
ALERT BOARD
C2473-03
DISPLAY ASSY
C5720-01
DECODER BOARD,
FLOW CONNECTOR
C2733-03
J301
FRONT
PANEL
MAIN BOARD
D2731-03
J101
SPARE
NEONATAL
HEATER
E1
F2 125mA
125V V FAST-ACT
F3 1/2A
125V V FAST-ACT
F4
125mA
125V
V FAST-ACT
RS232C/
NOVAMETRIX
ACCESSORIES
J100
SpO2
INPUT
J102
F1 62mA
125V V FAST-ACT
F5 1/2A
125V V FAST-ACT
BACKGROUND
MODE
J400
BOOT
SELECT
J401
AUXILIARY
SERIAL
J402
PROFILING
J404
AUXILIARY
DECODE
J411
J408
P408
ETCO2 INPUT BOARD
C2732-03
ETCO2
INPUT
J103
J301
EMI/RFI SHIELDING

			DO NOT SCALE UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES (mm) BREAK ALL SHARP EDGES TOLERANCES DEC ± ~ (mm) (± ~) FRAC ± ~ (mm) (± ~) HOLES +.007 -.003 (mm) (± ~) ANG ± ~	TITLE: OVERALL WIRING DIAGRAM, MODEL 8100 - COSMO+	NOVAMETRIX MEDICAL SYSTEMS INC. WALLINGFORD, CT U.S.A. 06492	
			MATERIAL ~	DRAWN Laug96 M.R. Lineback	CHECKED MRL	SIZE D / DRAWING NO. 6758 / CODE 09 / REV 01
01	N501	4Aug97	FINISH ~	MFG ENGR MJC 4/2/97	APPROVED RHD 4/2/97	
REV	R NO.	DATE		USED ON: 08758-00	SCALE: NONE	SHEET 1 OF 1

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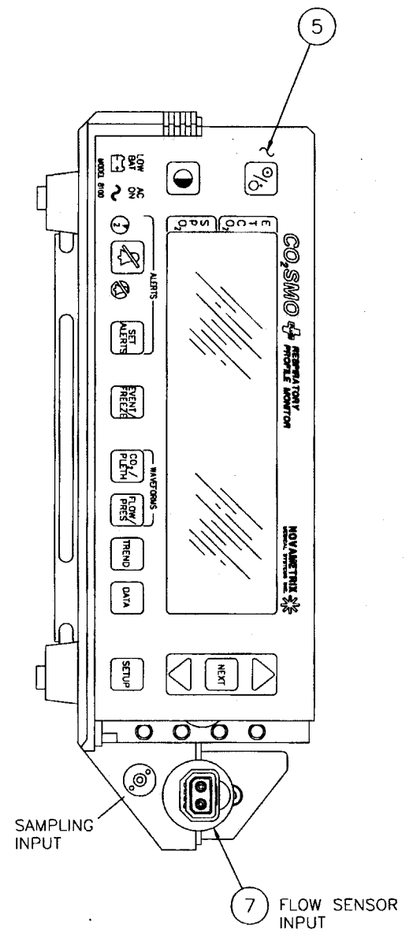

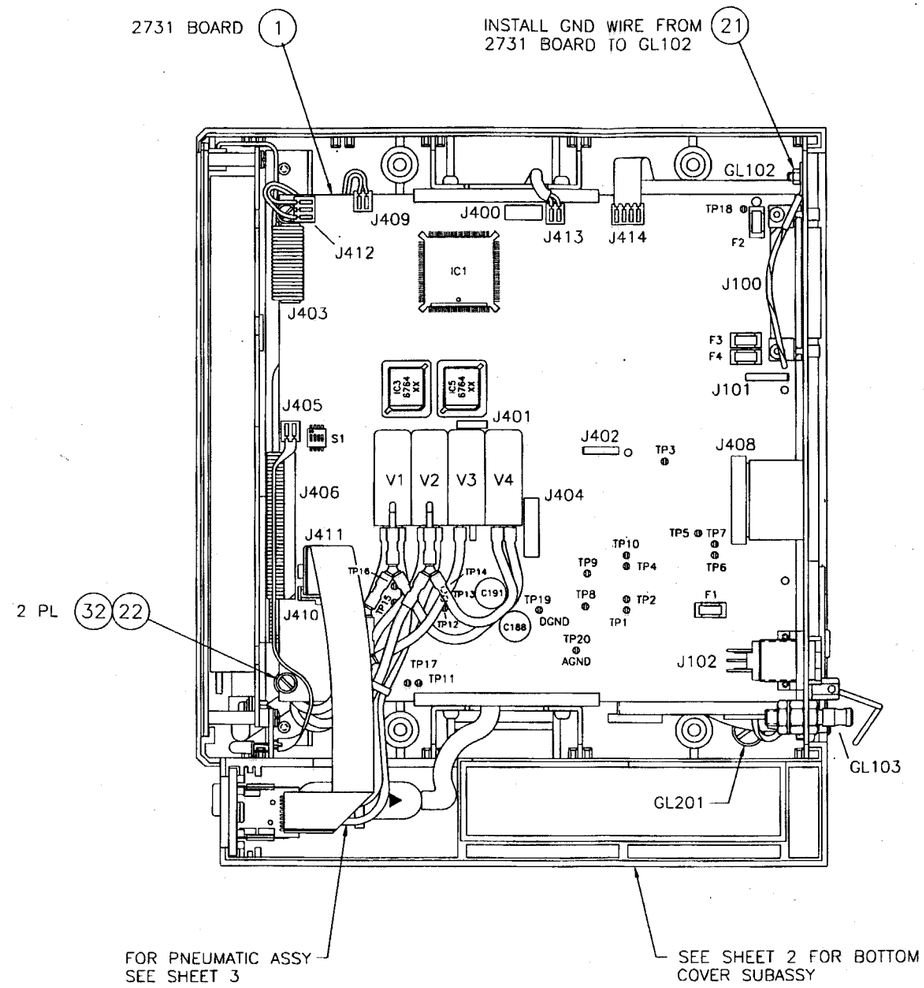

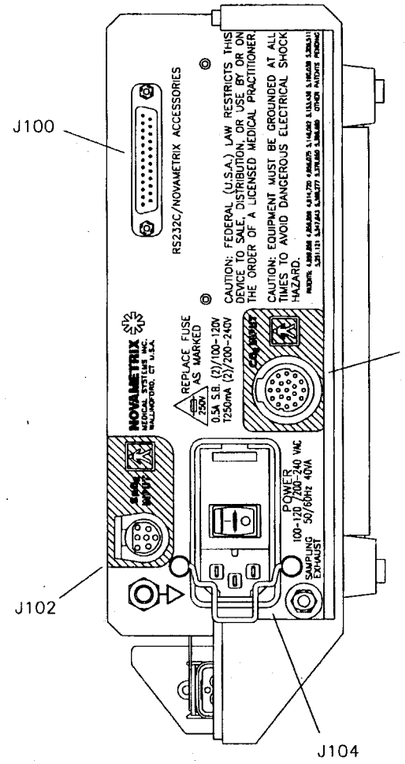
J100
RS232C/NOVAMETRIX ACCESSORIES
NOVAMETRIX
REPLACE FUSE AS MARKED
0.5A S.B. (2)100-120V
T250mA (2)200-240V
CAUTION: FEDERAL (U.S.A.) LAW RESTRICTS THIS DEVICE TO SALE, DISTRIBUTION, OR USE BY OR ON THE ORDER OF A LICENSED MEDICAL PRACTITIONER.
CAUTION: EQUIPMENT MUST BE GROUNDED AT ALL TIMES TO AVOID DANGEROUS ELECTRICAL SHOCK HAZARD.
J103
POWER 100-120, 200-240 VAC 50/60Hz 40VA
SAMPLING EXHAUST
J102
J104

			DO NOT SCALE UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES (mm) BREAK ALL SHARP EDGES TOLERANCES DEC ± ~ (mm) ± ~ FRAC ± ~ (mm) ± ~ HOLES +.007 -.003 (mm) (+.18 -.08) ANG ± ~	TITLE: MAIN ASSEMBLY, MODEL 8100 - COSMO+	NOVAMETRIX MEDICAL SYSTEMS INC. WALLINGFORD, CT U.S.A. 06492	
			MATERIAL ~	DRAWN RGG 15Jan97	CHECKED MRL 31Mar97	
02	N475	27May97		MFG ENGR MJC 4/2/97	APPROVED RHO 4/2/97	SIZE D / DRAWING NO. 6758 / CODE 01 / REV 02
01	N462	14Apr97	FINISH ~	USED ON: 6758-00		SCALE: 1/1 / SHEET 1 OF 3
REV	R NO.	DATE				

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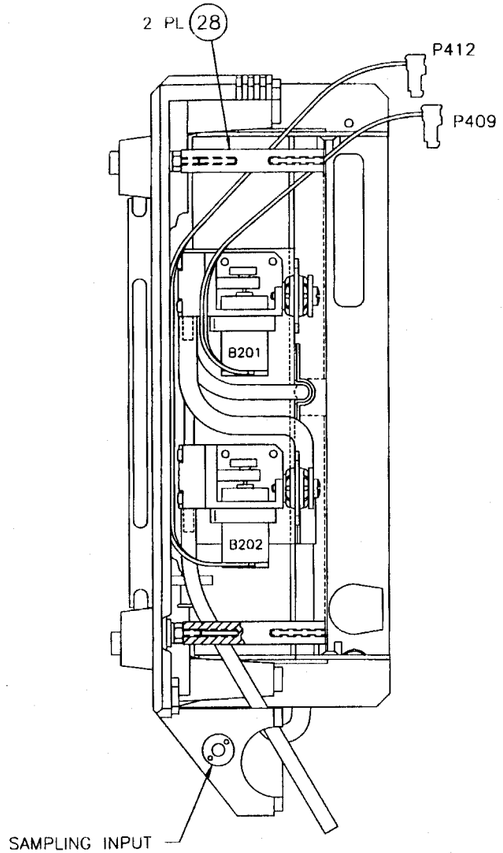

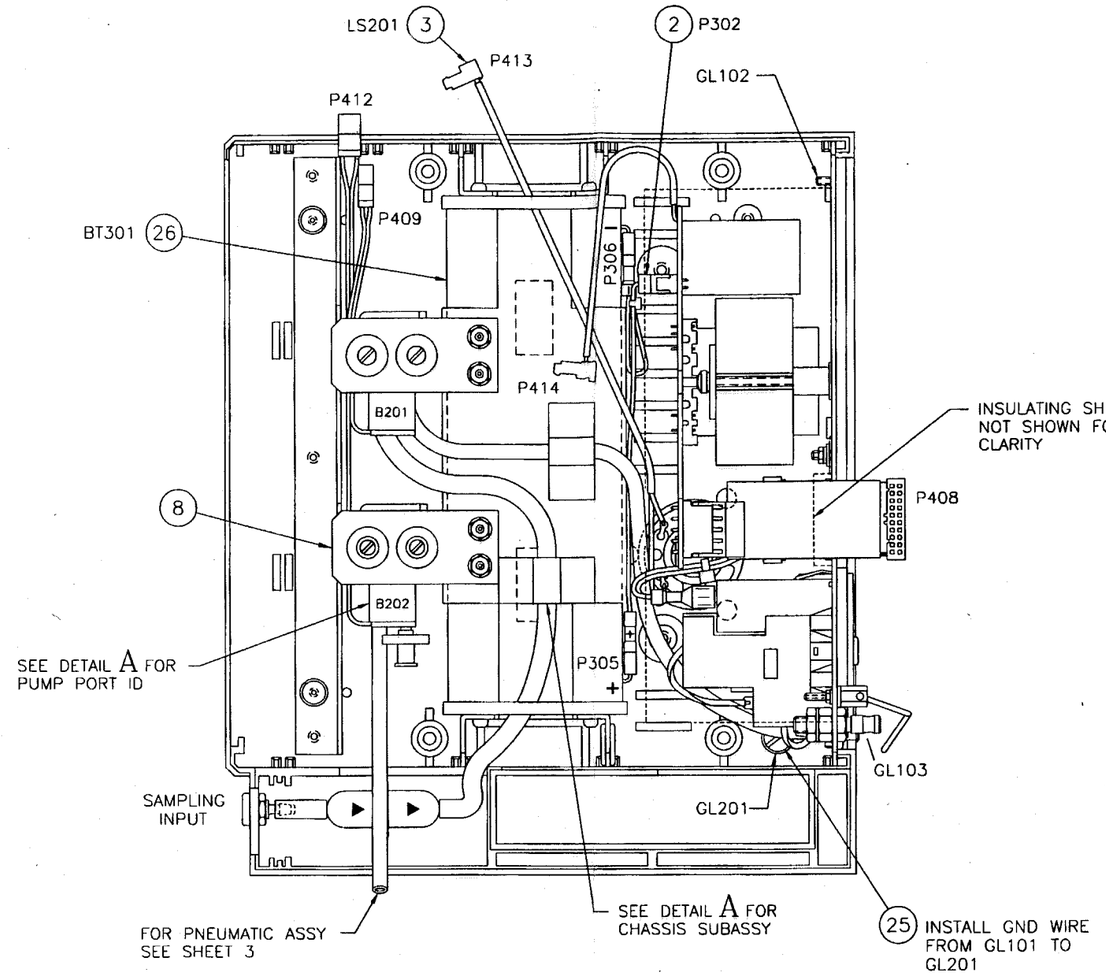

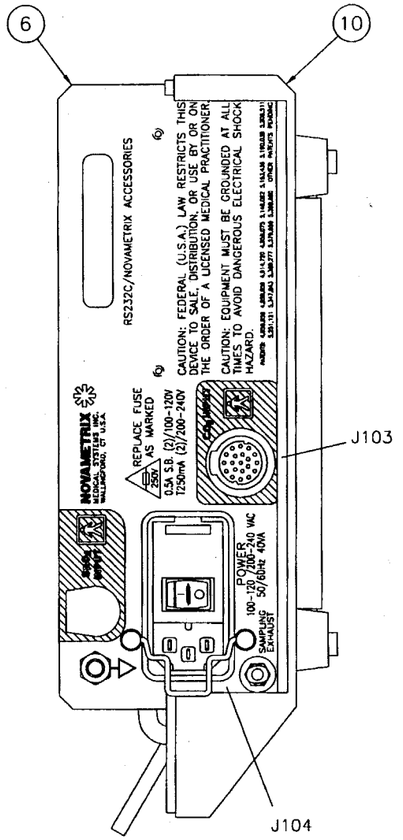

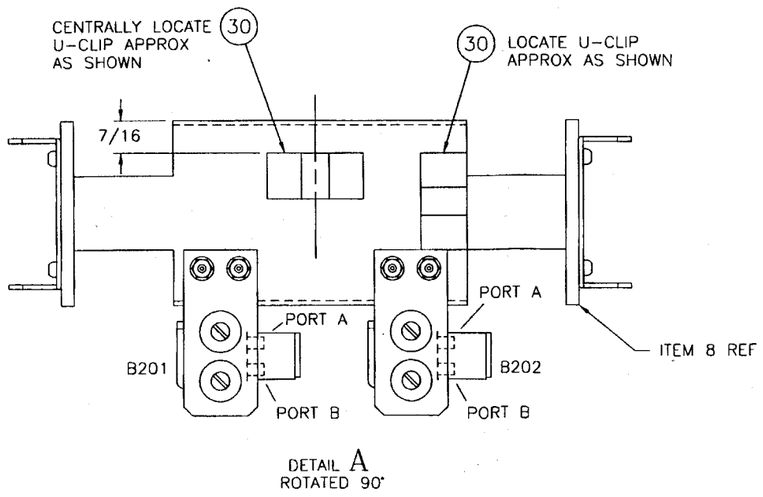

REV	R NO.	DATE
02	N475	27May97
01	N462	14Apr97

DO NOT SCALE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES (mm)
BREAK ALL SHARP EDGES
TOLERANCES
DEC ± ~ (mm) ± ~
FRAC ± 1/32 (mm) ± ~
HOLES + .007 −.003 (mm) (+.18 −.08)
ANG ± ~
MATERIAL ~
FINISH ~

TITLE: MAIN ASSEMBLY, MODEL 8100 − COSMO+

DRAWN RGG 15Jan97 | CHECKED MRL 31Mar97
MFG ENGR MJC 4/2/97 | APPROVED RHD 4/2/97
USED ON: 06758-00

NOVAMETRIX MEDICAL SYSTEMS INC. WALLINGFORD, CT U.S.A. 06492

SIZE	DRAWING NO	CODE	REV
D	6758	01	02

SCALE: 1/1 | SHEET 2 OF 3

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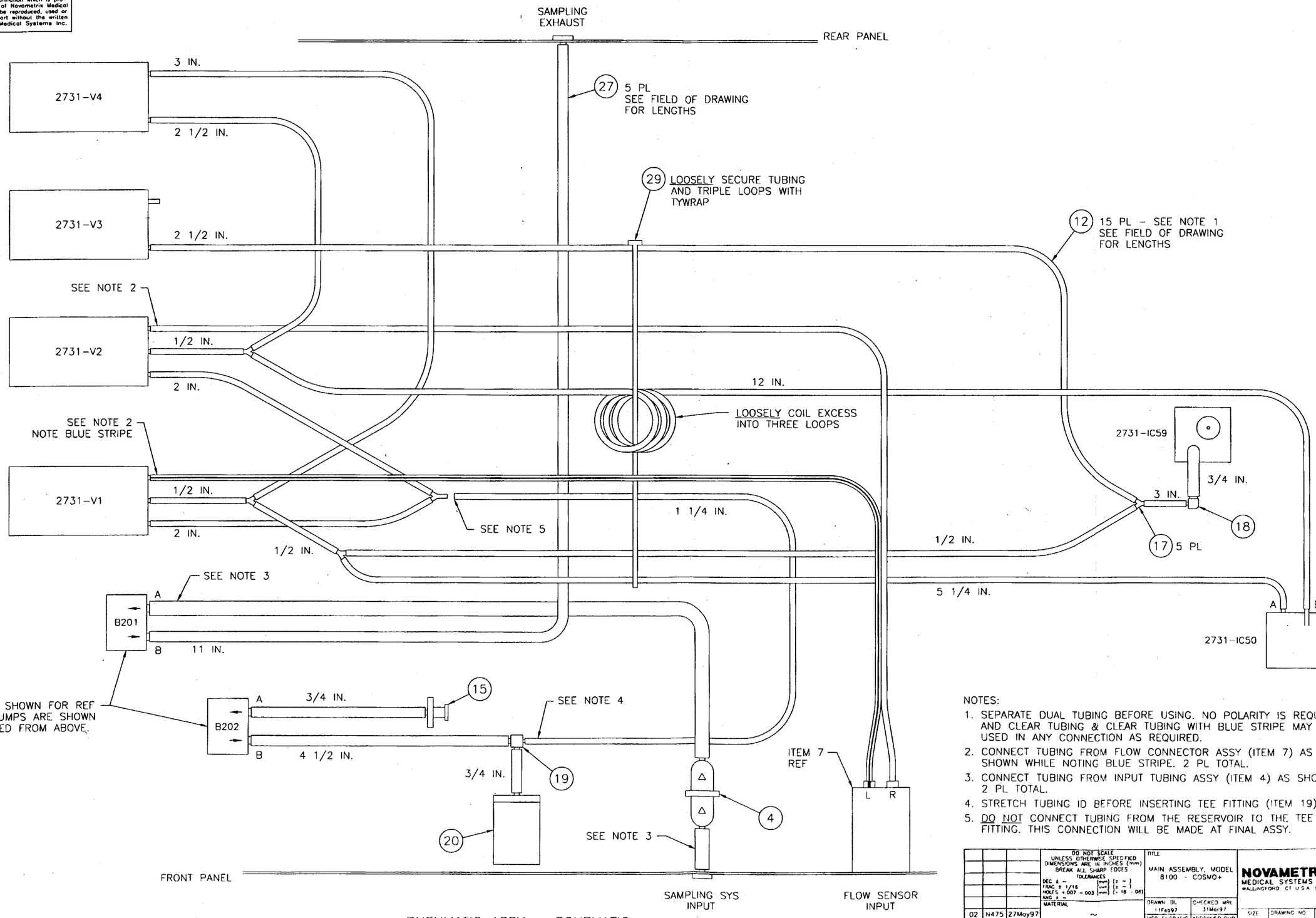

PNEUMATIC ASSY – SCHEMATIC

NOTES:

1. SEPARATE DUAL TUBING BEFORE USING. NO POLARITY IS REQUIRED AND CLEAR TUBING & CLEAR TUBING WITH BLUE STRIPE MAY BE USED IN ANY CONNECTION AS REQUIRED.
2. CONNECT TUBING FROM FLOW CONNECTOR ASSY (ITEM 7) AS SHOWN WHILE NOTING BLUE STRIPE. 2 PL TOTAL.
3. CONNECT TUBING FROM INPUT TUBING ASSY (ITEM 4) AS SHOWN. 2 PL TOTAL.
4. STRETCH TUBING ID BEFORE INSERTING TEE FITTING (ITEM 19).
5. DO NOT CONNECT TUBING FROM THE RESERVOIR TO THE TEE FITTING. THIS CONNECTION WILL BE MADE AT FINAL ASSY.

REV	R NO.	DATE
02	N475	27May97
01	N462	14Apr97

DO NOT SCALE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES (mm)
BREAK ALL SHARP EDGES
TOLERANCES
DEC ± ~ (mm) (± ~)
FRAC ± 1/16 (mm) (± ~)
HOLES +.007 -.003 (mm) (+.18 -.08)
ANG ± ~
MATERIAL ~
FINISH ~

TITLE: MAIN ASSEMBLY, MODEL 8100 - COSMO+

DRAWN BL 11Feb97	CHECKED MRL 11May97
MFG ENGR MJC 4/22/97	APPROVED RHD 4/22/97

USED ON 8758-00

NOVAMETRIX MEDICAL SYSTEMS INC. WALLINGFORD, CT U.S.A. 06492

SIZE	DRAWING NO	CODE	REV
D	6758	01	02

SCALE NONE SHEET 3 OF 3

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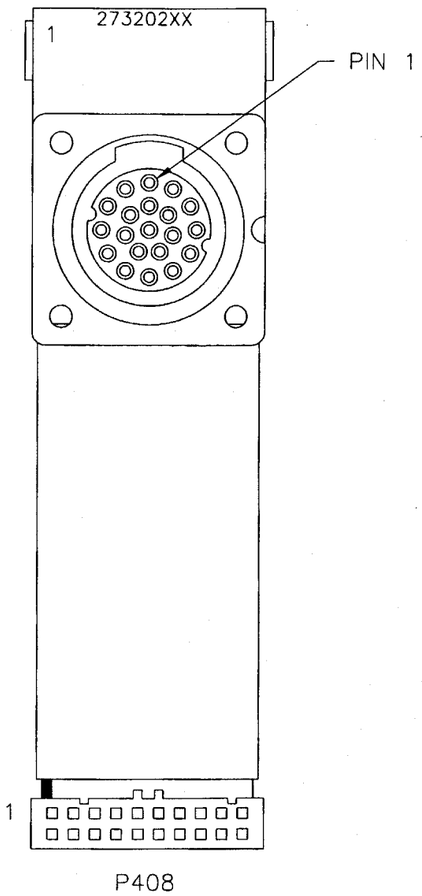
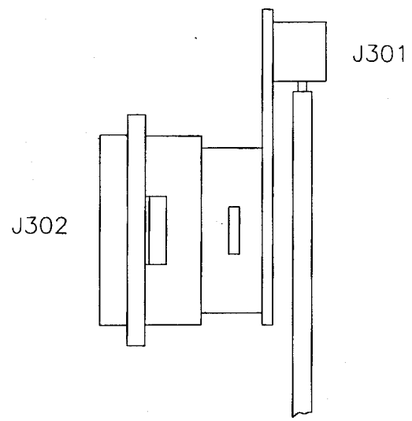
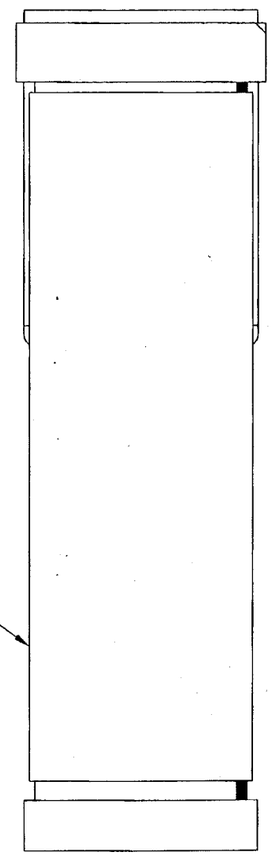
PN	DESCRIPTION	REF DES
2732-02	FAB, ETCO2 INPUT BOARD, MODEL 8100	~
C2732-03	SCHEMATIC, ETCO2 INPUT BOARD, MODEL 8100	~
212527	CONNECTOR, 20 PIN, RECEPTACLE	J302
600055	RIBBON CABLE ASSY, 20 PIN, 4 IN. L	J301
608126	TUBING, HEAT SHRINK, 1 IN. DIA, BLACK	FOR J301







REV	R NO.	DATE

DO NOT SCALE
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES (mm)
BREAK ALL SHARP EDGES
TOLERANCES
DEC ± ~ (mm) ± ~
FRAC ± ~ (mm) ± ~
HOLES +.007 -.003 (mm) (+.18 -.08)
ANG ± ~

MATERIAL ~

FINISH ~

TITLE: ETCO2 INPUT BOARD ASSY, MODEL 8100

DRAWN BL 220ct96 | CHECKED MR 7 JAN 97

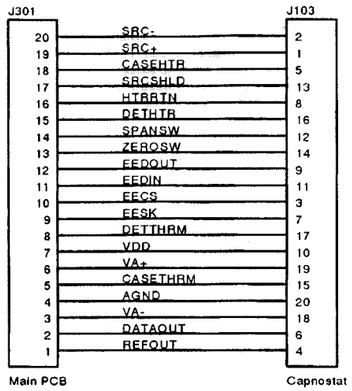
MFG ENGR MC 1/7/97 | APPROVED RMO 7 JAN 97

USED ON: D6692-01

NOVAMETRIX MEDICAL SYSTEMS INC.
WALLINGFORD, CT U.S.A. 06492

SIZE	DRAWING NO.	CODE	REV
C	2732	01	00

SCALE: 2/1 | SHEET 1 OF 1



			CO2 Interface PCB, COSMO+		Novametrix Medical Systems, Inc. 1 Barnes Industrial Park Road Wallingford, CT USA 06492		
			Drawn: R.Daniels 28Jan97	Checked: MGL			
			Mfg./Eng.: MBK 4/12/97	Approved: RHD 5/2/97	Size B	Document Number 2732	Code 03	Rev 00
			File: 27320300		Sheet 1 of 1		
Rev.	"R" No.	By Date	Date: Wednesday, March 26, 1997				

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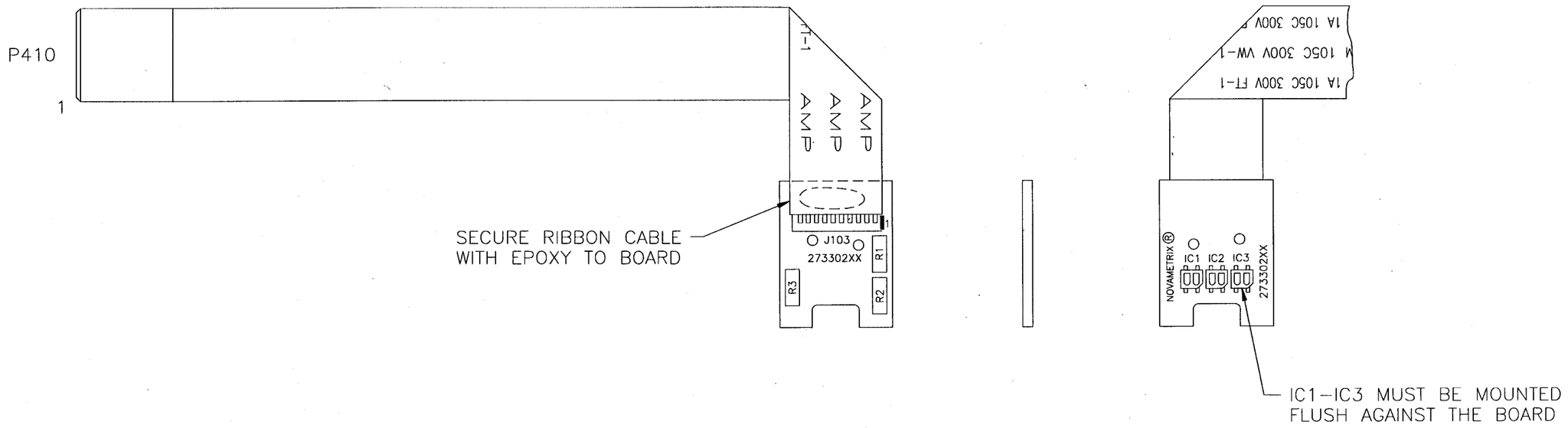
PN	DESCRIPTION	REF DES
2733-02	FAB, DECODER BOARD, FLOW CONNECTOR	~
C2733-03	SCHEMATIC, DECODER BOARD, FLOW CONNECTOR	~
C6910-10	RIBBON CABLE, DECODER BOARD, 10 PIN	(FOR J103)
161060	EPOXY, 2 PART (5/7), GRAY	(FOR J103)
474157	RESISTOR, 511 OHM, 1/8W, 1%	R1-R3
487124	IC, ERT-3281, REFLECTIVE SENSOR, HIGH SPEED	IC1-IC3



REV	R NO.	DATE
04	N528	24Nov97
03	N512	25Sep97
02	N468	29Apr97
01	Prod	Release

DO NOT SCALE
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES (mm)
BREAK ALL SHARP EDGES
TOLERANCES
DEC ± ~ (mm) ± ~
FRAC ± ~ (mm) ± ~
HOLES +.007 -.003 (mm) (+.18 -.08)
ANG ± ~
MATERIAL ~
FINISH ~

TITLE
DECODER BD ASSY,
FLOW CONNECTOR,
MODEL 8100

DRAWN *BL* 24Oct96 | CHECKED **MRL** **22Jan97**
MFG ENGR MJC 1/23/97 | APPROVED RHD 21Jan97
USED ON: C6693-01

NOVAMETRIX
MEDICAL SYSTEMS INC.
WALLINGFORD, CT U.S.A. 06492

SIZE	DRAWING NO.	CODE	REV
C	2733	01	04

SCALE: 2/1 | SHEET 1 OF 1

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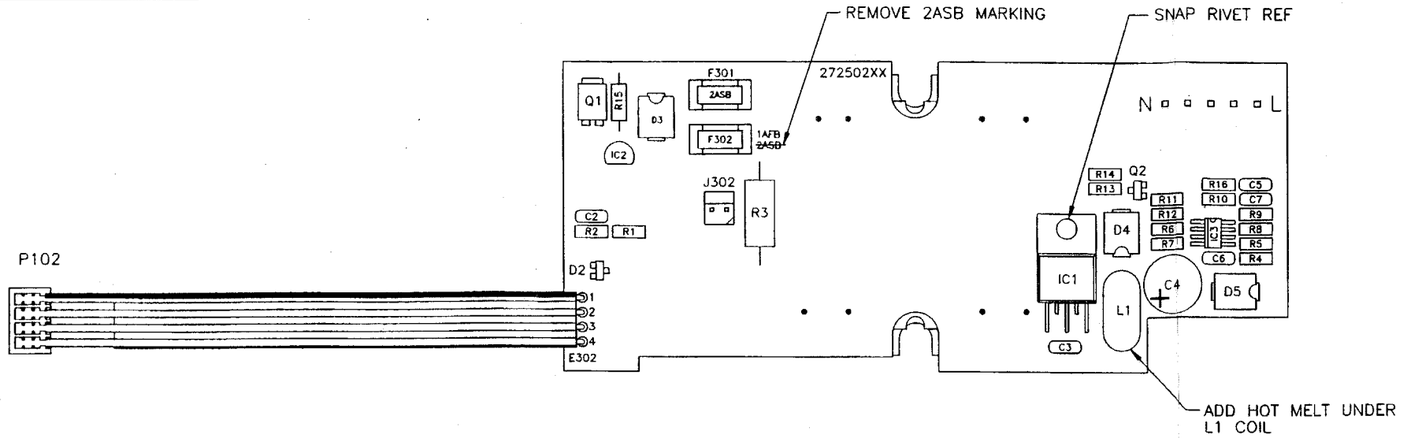

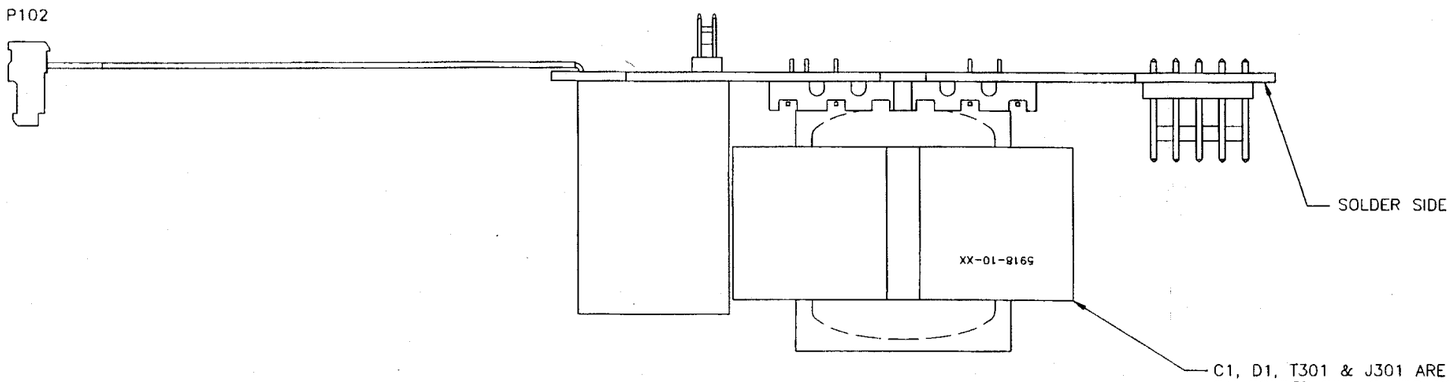

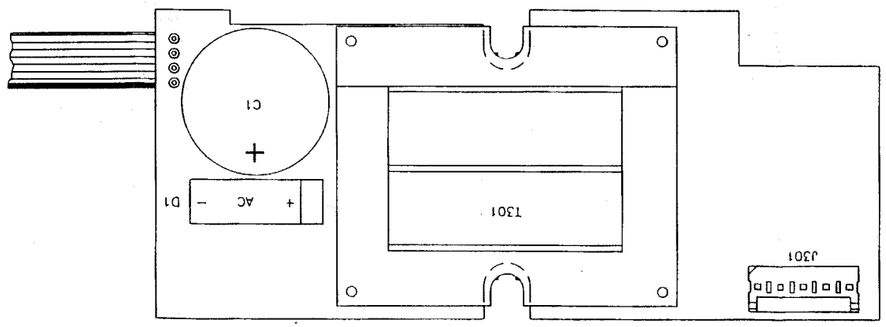

D2726-17 SUBASSEMBLY		
PN	DESCRIPTION	REF DES
2725-02	FAB, POWER SUPPLY BOARD, 2ND GENERATION	~
☆D5918-10	TRANSFORMER, MAINS, POWER SUPPLY BOARD	T301
☆ 152029	CAPACITOR, 220uF 20%, 35V, ELECTROLYTIC	C4
☆ 152081	CAPACITOR, 6800uF, 35V, 20%, ELECTROLYTIC	C1
154072	CAPACITOR, .1uF, 50V, 10%, X7R, CERAMIC CHIP	C2, C3, C5-C7
☆ 180014	INDUCTOR, 25uH, .25 SPACING	L1
☆ 211213	CONNECTOR, 2 PIN, POST HEADER	J302
☆ 211505	CONNECTOR, 5 PIN, SQUARE POST HEADER	J301
280114	SNAP RIVET, .118-.158 THK PANEL	FOR IC1
☆470026	RESISTOR, 150 OHM, 1/4W, 10%	R15
474145	RESISTOR, 215 OHM, 1/8W, 1%	R11
474151	RESISTOR, 37.4k OHM, 1/8W, 1%	R6
474162	RESISTOR, 61.9k OHM, 1/8W, 1%	R13
474165	RESISTOR, 10k OHM, 1/8W, 1%	R10
474166	RESISTOR, 100k OHM, 1/8W, 1%	R5, R7, R9
474167	RESISTOR, 2.2M OHM, 1/8W, 1%	R2
☆474181	RESISTOR, 4.3 OHM, 1W, 5%	R3
474211	RESISTOR, 49.9k OHM, 1/8W, 1%	R4
474214	RESISTOR, 332k OHM, 1/8W, 1%	R1, R14
474215	RESISTOR, 2.21k OHM, 1/8W, 1%	R16
474216	RESISTOR, 4.99k OHM, 1/8W, 1%	R12
474218	RESISTOR, 47.5k OHM, 1/8W, 1%	R8
481044	DIODE, ZENER, BZX84C12LT1, 12V	D2
☆ 481530	DIODE, KBU4D, 4 AMP, BRIDGE RECTIFIER	D1
481552	DIODE, MBRS340T3, SCHOTTKY, 40V, 3A	D3, D4, D5
☆ 484529	VOLTAGE REGULATOR, LM78L05ACZ, 5V, 100MA	IC2
☆ 484559	VOLTAGE REGULATOR, LT1076CT FLOW 30, 2A	IC1
485532	TRANSISTOR, 2N7002T1, N-CHANNEL, ENHAN	Q2
☆ 485535	TRANSISTOR, IRFD9020, P-CHANNEL, MOSFET	Q1
486805	IC, LM393M, DUAL VOLTAGE COMP, L PWR	IC3
515083	FUSE W FUSEHOLDER, 1A, 125V, V FAST-ACTING	F302
515085	FUSE WITH FUSEHOLDER, 2A, 125V, SLO-BLO	F301
600034	RIBBON CABLE ASSY, 4 PIN, 4 INCHES LONG	P102

D2726-01 ASSEMBLY		
PN	DESCRIPTION	REF DES
D2726-03	SCHEMATIC, POWER SUPPLY BOARD	~
A2726-04	TEST PROCEDURE, POWER SUPPLY BOARD	~
D2726-17	POWER SUPPLY BOARD SUBASSY	~

NOTES:
1. D2726-17 SPECIFICATIONS: ☆ DENOTES THRU HOLE COMPONENTS.
2. D2726-01 SPECIFICATIONS: FOR TEST PROCEDURE SEE A2726-04.

DRAWING TABULATION		
DWG NO.	TITLE	NEXT ASSY
D2726-17	POWER SUPPLY BOARD SUBASSY	D2726-01
D2726-01	POWER SUPPLY BOARD ASSY	~

REV	R NO.	DATE
03	N508	29Aug97
02	N433	29Jan97
01	N377	26Dec95
00	N372	29Sep95

DO NOT SCALE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES (mm)
BREAK ALL SHARP EDGES
TOLERANCES
DEC ± ~ (mm) ± ~
FRAC ± ~ (mm) ± ~
HOLES +.007 -.003 (mm) (+.18 -.08)
ANG ± ~
MATERIAL ———
FINISH ———

TITLE: POWER SUPPLY BOARD ASSY, MODEL 515A SB, 520A, 1265 & 7100

DRAWN RGG 7Aug95 | CHECKED BL 7Nov95
MFG ENGR EH 11-8-95 | APPROVED AJE 9Nov95
USED ON: SEE TABULATION

NOVAMETRIX MEDICAL SYSTEMS INC.
WALLINGFORD, CT U.S.A. 06492

SIZE	DRAWING NO.	CODE	REV
D	2726	17 01	03

SCALE: 2/1 | SHEET 1 OF 1

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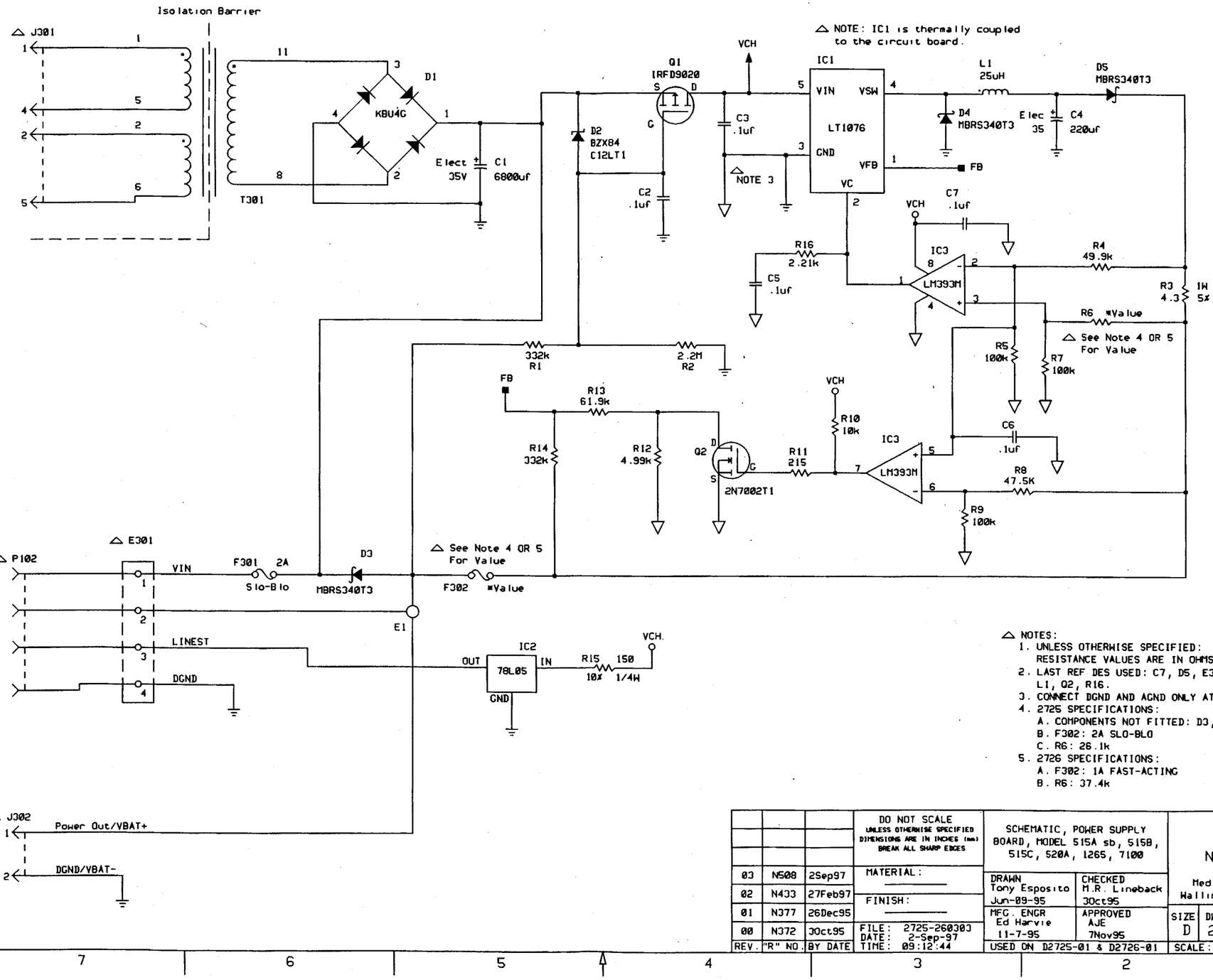

△ NOTES:
1. UNLESS OTHERWISE SPECIFIED: RESISTANCE VALUES ARE IN OHMS, 1/8W, 1%
2. LAST REF DES USED: C7, D5, E301, F302, IC3, J302, L1, Q2, R16.
3. CONNECT DGND AND AGND ONLY AT IC1-3.
4. 2725 SPECIFICATIONS:
   A. COMPONENTS NOT FITTED: D3, F301, IC2, R15, P102
   B. F302: 2A SLO-BLO
   C. R6: 26.1k
5. 2726 SPECIFICATIONS:
   A. F302: 1A FAST-ACTING
   B. R6: 37.4k

REV.	"R" NO.	BY	DATE
03	N508		2Sep97
02	N433		27Feb97
01	N377		26Dec95
00	N372		30ct95

DO NOT SCALE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES (mm) BREAK ALL SHARP EDGES

MATERIAL: ——

FINISH: ——

FILE: 2725-260303
DATE: 2-Sep-97
TIME: 09:12:44

SCHEMATIC, POWER SUPPLY BOARD, MODEL 515A sb, 515B, 515C, 520A, 1265, 7100

DRAWN	CHECKED
Tony Esposito Jun-09-95	M.R. Lineback 30ct95
MFG. ENGR Ed Harvie 11-7-95	APPROVED AJE 7Nov95

USED ON D2725-01 & D2726-01

NOVAMETRIX
Medical Systems, Inc.
Wallingford, CT USA 06492

SIZE	DWG NO.	CODE	REV.
D	2725 & 2726	03	03

SCALE: NONE | SHEET 1 OF 1

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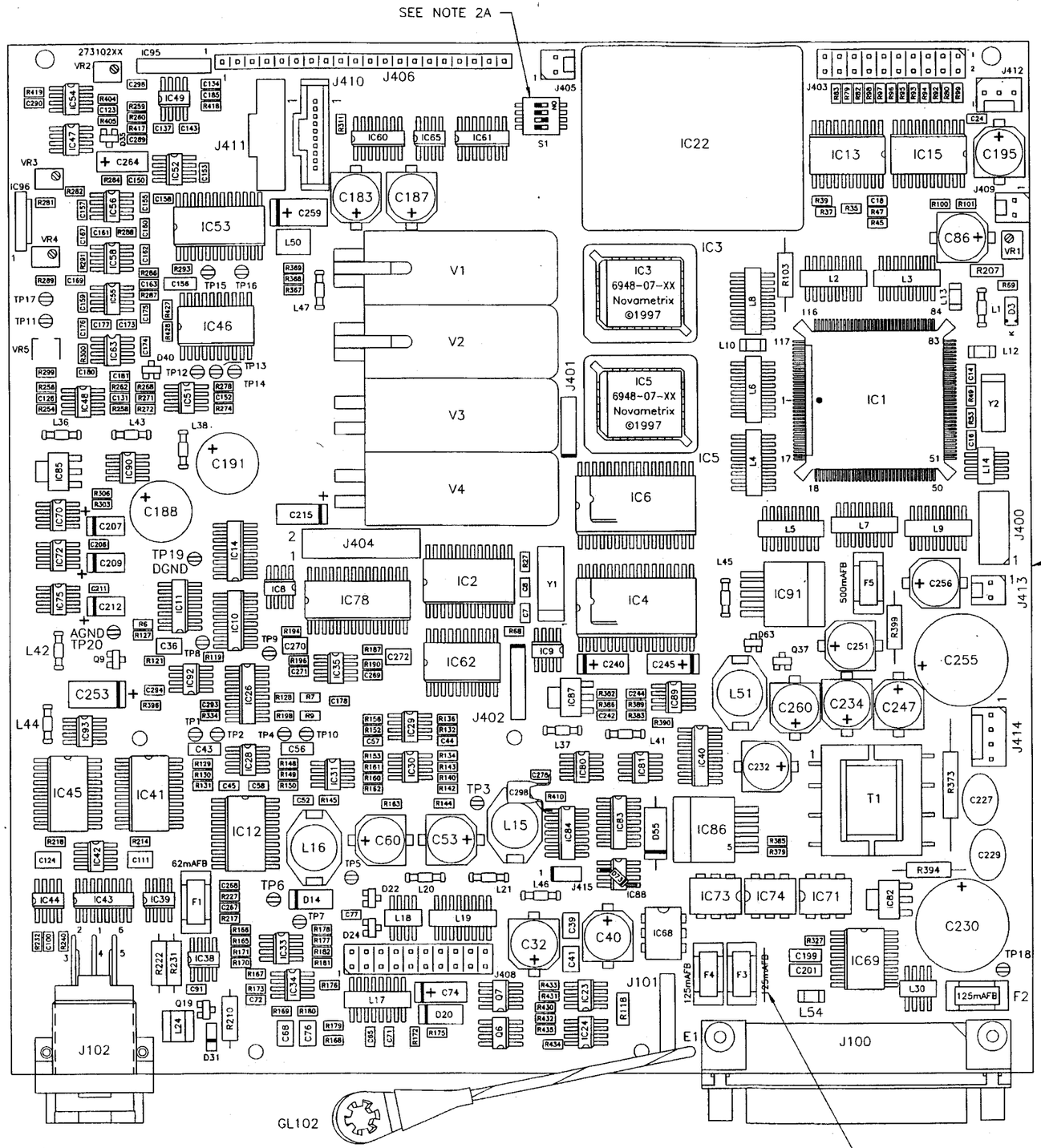
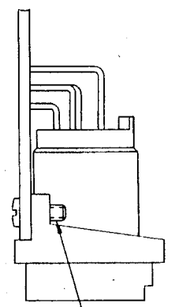


CONNECT C298 FROM IC84-1 TO OUTSIDE PAD OF C278 APPROX AS SHOWN

CONNECT D73 FROM IC88-2 TO IC88-5 APPROX AS SHOWN

DETAIL A
SCALE: 4/1

SEE SHEET 2 FOR BOTTOM SIDE ASSEMBLY



SCREW, 2-56 X 1/4 L
2 PL

REMOVE 125mA MARKING

NOTES:

1. D2731-17 SPECIFICATIONS:
   A. COMPONENTS NOT FITTED: C33, C34, C175, C177, C181, C264, C266, C278, D68, IC63, IC64, IC95, IC96, J101, J400-J402, J404, J411, J415, R20, R104, R105, R228, R281, R289, R299, R310, R396, R414, VR5
   B. SEE DETAIL A FOR COMPONENT SIDE MODIFICATIONS.
2. D2731-01 SPECIFICATIONS:
   A. SET S1 AS SHOWN.
   B. FOR TEST PROCEDURE SEE A2731-04.

DRAWING TABULATION		
DWG NO.	TITLE	NEXT ASSY
D2731-17	MAIN BOARD SUBASSY, MODEL 8100 - COSMO+	D2731-01
D2731-01	MAIN BOARD ASSY, MODEL 8100 - COSMO+	D6758-01

REV	R NO.	DATE
03	N501	8Aug97
02	N475	28May97
01	Prod	Release

DO NOT SCALE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES (mm)
BREAK ALL SHARP EDGES
TOLERANCES
DEC ± ~ (mm) (± ~)
FRAC ± ~ (mm) (± ~)
HOLES +.007 -.003 (mm) (± ~)
ANG ± ~
MATERIAL ~
FINISH ~

TITLE: MAIN BOARD ASSY, MODEL 8100 - COSMO+

DRAWN BL 15Apr97 | CHECKED MRL 11Oct98
MFG ENGR MJC 5/13/97 | APPROVED RMD 28May97
USED ON SEE TABULATION

NOVAMETRIX MEDICAL SYSTEMS INC.
WALLINGFORD, CT U.S.A. 06492

SIZE D | DRAWING NO. 2731 | CODE 17 01 | REV 03
SCALE NONE | SHEET 1 OF 3

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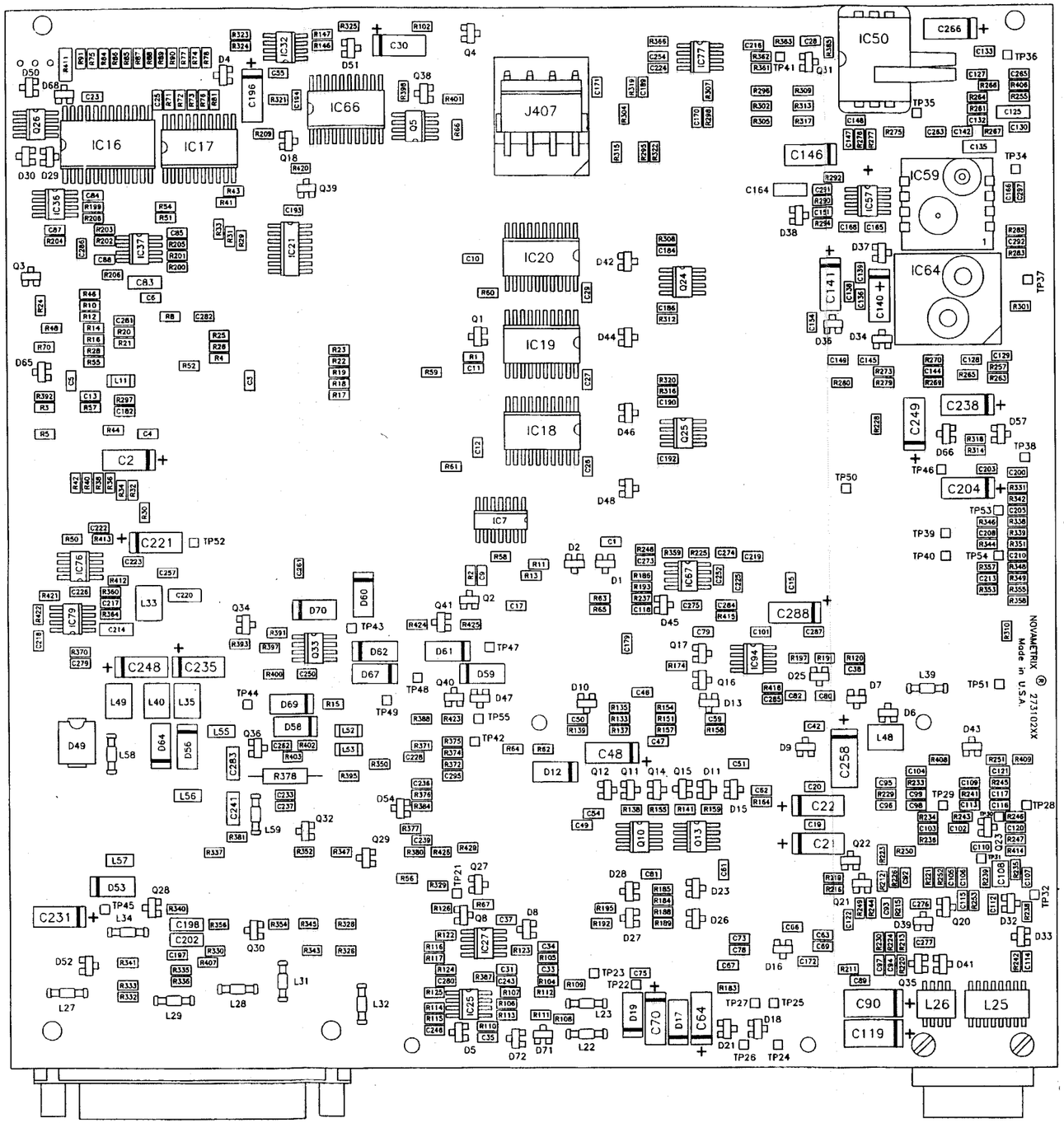

DRAWING TABULATION		
DWG NO.	TITLE	NEXT ASSY
D2731-17	MAIN BOARD SUBASSY, MODEL 8100	D2731-01
D2731-01	MAIN BOARD ASSY, MODEL 8100	D6758-01

DO NOT SCALE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES (mm)
BREAK ALL SHARP EDGES
TOLERANCES
DEC ± ~
FRAC ± ~ (mm) (± ~)
HOLES ± .007 -.003 (mm) (± ~)
ANG ± ~

REV	R NO.	DATE
03	N501	4Aug97
02	N475	28May97
01	Prod	Release

MATERIAL ~
FINISH ~

TITLE: MAIN BOARD ASSY, MODEL 8100 - COSMO+

DRAWN BL 110ct96 | CHECKED MRL 15Apr97
MFG ENGR MJC 5/13/97 | APPROVED RHO 28May97
USED ON: SEE TAB.

NOVAMETRIX
MEDICAL SYSTEMS INC.
WALLINGFORD, CT U.S.A. 06492

SIZE D- | DRAWING NO. 2731 | CODE 17 01 | REV 03
SCALE: NONE | SHEET 2 OF 3

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D2731-01 ASSEMBLY

PN	DESCRIPTION	REF DES
02731-03	SCHEMATIC, MAIN BOARD, MODEL 8100	~
A2731-04	TEST PROCEDURE, MAIN BOARD, MODEL 8100	~
02731-17	MAIN BOARD SUBASSY, MODEL 8100	~
A6948-07	PROGRAM SET, FLASH PEROM ASSY W BOOT CODE	IC3, IC5
487110	IC, 1220A-015A-3S, PRESSURE TRANSDUCER	IC59
487122	IC, SLP004D04, LOW PRESSURE SENSOR	IC50

D2731-17 SUBASSEMBLY

2731-02	FAB, MAIN BOARD, MODEL 8100	~
B5844-01	CONNECTOR & BRACKET ASSY, SPO2 INPUT	J102
☆C6756-10	TRANSFORMER, MAIN BOARD	T1
☆B6799-01	GROUND WIRE ASSY, 3 IN. LONG, MAIN BOARD	GL302 FOR E1
☆ 152084	CAPACITOR, 470uF, 25V, 20%, ELECTROLYTIC	C188, C191
☆ 152085	CAPACITOR, 1500uF, 16V, ELECTROLYTIC	C230, C255
152096	CAPACITOR, 220uF, 35V, 20%, ELECTROLYTIC	C32, C40, C53, C60, C86, C183, C187, C195, C232, C234, C247, C251, C256, C260
153045	CAPACITOR, .47uF, 50V, .200 SPACING	C298
☆ 153063	CAPACITOR, 220pF, 3kV, 20%, CERAMIC DISC	C227, C229
154072	CAPACITOR, .1uF, 50V, 10%, X7R	C36, C43, C56, C83, C125, C135, C156, C164, C198, C199, C201, C202, C214, C220, C241
154079	CAPACITOR, 10uF, 16V, 10%, TANTALUM	C2, C21, C22, C74, C140 C141, C146, C196, C204, C215, C221, C231
154081	CAPACITOR, 100pF, 100V, 10%	C283
154086	CAPACITOR, 4.7uF, 10VDC, 20%, TANTALUM	C207, C209, C212
154093	CAPACITOR, 68uF, 16VDC, 10%, TANTALUM	C90, C119, C253, C258, C259
154103	CAPACITOR, .001uF, 50VDC, 10%, X7R	C152, C185, C237, C244, C273, C280, C293
154104	CAPACITOR, .01uF, 50VDC, 10%, X7R	C1, C3-C6, C9-C13, C15, C17-C20, C23-C29, C31, C35, C37, C42, C44, C46, C47, C49-C52, C54, C55, C57, C59, C61-C63, C65-C67, C69, C71-C73, C75, C77-C82, C84, C85, C87, C89, C91-C99, C101, C102, C104-C107, C109, C110, C112, C113, C115--C118, C121-C123, C126--C131, C133, C134, C136--C139, C143-C145, C147--C151, C153-C155, C157, C158, C160-C163, C165--C167, C169-C174, C176, C178-C180, C184, C186, C189, C190, C192-C194, C197, C200, C203, C205, C206, C208, C210, C211, C213, C216-C219, C222--C226, C228, C233, C236, C242, C243, C246, C250, C257, C261, C263, C265, C267, C268, C274, C275, C279, C287, C289, C290, C294
154105	CAPACITOR, 47pF, 50VDC, 5%, NPO	C100, C114, C262, C269, C271, C276, C277
154106	CAPACITOR, 22pF, 50VDC, 5%, NPO	C7, C8, C14, C16, C182
154108	CAPACITOR, 100pF, 50VDC, 5%, MLTILYR CER	C252, C254, C281, C282, C284, C285
154111	CAPACITOR, .1uF, 16VDC, 5%, 1210 CASE	C39, C41, C68, C76, C108, C111, C124, C270, C272
154112	CAPACITOR, .047uF, 16VDC, 10%, X7R	C38, C45, C58, C88, C103, C120, C132, C142, C159, C168, C239, C286, C291 C292, C295, C296, C297
154116	CAPACITOR, 10uF, 35V, 10%, LOW ESR	C30, C48, C64, C70, C235, C238, C240, C245, C248, C249, C288
180019	INDUCTOR, 100uH, 10%	L24
180022	INDUCTOR, 10uH, 10%	L33, L35, L40, L48-L50
180029	INDUCTOR, 50MHz CUT-OFF FREQUENCY	L10-L13, L52-L54
180030	INDUCTOR-CAP, 4700pF, 50VDC, 2A, 3 TERMINAL	L1, L20-L23, L27-L29, L31, L32, L34, L36-L39, L41-L44, L46, L47

D2731-17 SUBASSEMBLY

PN	DESCRIPTION	REF DES
180034	FERRITE FILTER, 4 LINE, EMI SUPPRESSION	L14, L18, L26, L30
180035	FERRITE FILTER, 8 LINE, EMI SUPPRESSION	L2-L9, L17, L19, L25
180045	INDUCTOR, 220uH, 20%, .53 OHMS 15% DCR	L15, L16, L51
180047	INDUCTOR, 50 OHMS @ 100M Hz, 3A	L55-L57
180048	EMI FILTER, W FERRITE, 3300pF, 100V, 3 TERM	L45, L58, L59
☆ 210051	CONNECTOR, 25 PIN, RECEPTACLE, RIGHT ANGLE	J100
☆ 211213	CONNECTOR, 2 PIN, POST HEADER	J405, J409, J413
☆ 211327	CONNECTOR, 3 PIN, HEADER, STR, .1 SP	J412
☆ 211412	CONNECTOR, 4 PIN, HEADER, RIGHT ANGLE	J407
☆ 211414	CONNECTOR, 4 PIN, PLUG, FRICTION LOCK	J414
☆ 212133	CONNECTOR, 10 PIN, HEADER, SHROUDED	J410
☆ 212501	20 PIN CONNECTOR I/O HEADER	J403, J408
☆ 212529	CONNECTOR, 20 PIN, HEADER, STRAIGHT	J406
215073	SOCKET, PLCC, 32 PIN, .05 SPACING, LOW PROFILE	(FOR IC3 & IC5)
216029	TEST POINT, SPRING LOADED, 475'C MAX	TP1-TP20
230024	CRYSTAL, 32.768 kHz	Y2
230025	CRYSTAL, 3.6864 MHz	Y1
☆ 250146	VALVE, SOLENOID, 5V, 0-30 PSIG, 3-WAY	V1, V2
☆ 250151	VALVE, SOLENOID, 5V, 0-30 PSIG, 2-WAY	V3, V4
281211	SCREW, BINDING HD, SELF-TAPPING, 2-56 X 1/4	(FOR J102)
☆ 400042	INVERTER, DC TO AC, 12VDC INPUT	IC22
☆ 470109	RESISTOR, 470k OHM, 1/2W, 10%	R394
☆ 471400	RESISTOR, 100M OHM, 1W, 5%	R373
☆ 472198	RESISTOR, 3.3 OHM, 1/4W, 1%	R222
☆ 472200	RESISTOR, 5.6 OHM, 1/4W, 1%	R231
☆ 472274	RESISTOR, 26.7 OHM, 1/4W, 1%	R210
☆ 474008	RESISTOR, 470 OHM, 1/2W, 10%	R378, R399
☆ 474032	RESISTOR, 10 OHM, 1/2W, 5%	R103
474172	RESISTOR, 10 OHM, 1/8W, 1%	R411
474194	RESISTOR, 2.2M OHM, 1/16W, 5%	R143, R161
474195	RESISTOR, 511k OHM, 1/16W, 1%	R186, R371, R375
474197	RESISTOR, 49.9k OHM, 1/16W, 1%	R115, R125, R133, R135, R151, R154, R165, R166, R177, R178, R255, R323, R325, R369, R398
474198	RESISTOR, 2.49k OHM, 1/16W, 1%	R130, R131, R149, R150, R225, R260
474222	RESISTOR, 10 OHM, 1/16W, 1%	R21, R229, R233, R241, R245, R301, R331, R342, R346, R351, R357, R405
474223	RESISTOR, 49.9 OHM, 1/16W, 1%	R172, R175
474224	RESISTOR, 100 OHM, 1/16W, 1%	R70, R79-R83, R92-R99, R102, R126-R128, R136, R144, R156, R163, R174, R191, R197, R198, R203, R221, R239, R250-R253, R256, R262, R264, R270, R278, R285, R292, R297 R300, R360, R365, R386, R428
474225	RESISTOR, 499 OHM, 1/16W, 1%	R69, R145, R164, R190, R196, R275, R291, R329, R340, R347, R354, R382
474227	RESISTOR, 1k OHM, 1/16W, 1%	R68, R119, R168, R179, R184, R185, R188, R189, R192, R195, R217, R227, R235, R238, R240, R268, R272, R273, R280, R298, R303, R304, R307, R311, R315, R319, R327, R330, R332, R333, R335, R336, R341, R350, R356, R364, R404, R407, R429, R430, R431
474228	RESISTOR, 1.21k OHM, 1/16W, 1%	R200, R277, R406
474229	RESISTOR, 2.05k OHM, 1/16W, 1%	R193, R381, R383, R387, R403
474230	RESISTOR, 3.32k OHM, 1/16W, 1%	R139, R158, R236, R247, R402
474231	RESISTOR, 4.99k OHM, 1/16W, 1%	R3, R5, R129, R148, R353
474233	RESISTOR, 10k OHM, 1/16W, 1%	R4, R6, R7, R9, R11, R13, R15, R17-R19, R22-R43, R45-R48, R50-R52, R54--R62, R64-R67, R71-R78, R84-R91, R106-R114, R120, R122, R124, R208, R209, R211, R214, R218, R257, R265, R321, R338, R339, R344, R348, R349, R355, R358, R359, R363, R367, R370, R384, R393, R395, R401, R412, R413, R415, R416, R417, R418, R419, R424, R425, R427

D2731-17 SUBASSEMBLY

PN	DESCRIPTION	REF DES
474234	RESISTOR, 20.5k OHM, 1/16W, 1%	R116, R137, R157
474235	RESISTOR, 24.9k OHM, 1/16W, 1%	R134, R153, R199, R204, R216, R219, R249, R259, R334, R361, R368, R397
474236	RESISTOR, 33.2k OHM, 1/16W, 1%	R117, R140, R160, R212, R220, R223, R230, R362, R366, R385
474238	RESISTOR, 37.4k OHM, 1/16W, 1%	R389, R147
474239	RESISTOR, 75k OHM, 1/16W, 1%	R176, R205, R206, R266, R267, R286, R287, R293, R294
474240	RESISTOR, 100k OHM, 1/16W, 1%	R1, R2, R8, R10, R12, R14, R16, R44, R63, R100, R101, R132, R138, R142, R152, R155, R162, R173, R180, R183, R213, R224, R232, R242-R244, R254, R258, R263, R269, R271, R296, R302, R305, R309, R313, R317, R324, R326, R328, R337, R343, R345, R352, R376, R379, R391, R392, R400, R408, R409, R420, R423, R426
474241	RESISTOR, 150k OHM, 1/16W, 1%	R123, R201, R202, R234, R246, R261, R283, R290, R314, R322, R388
474242	RESISTOR, 249k OHM, 1/16W, 1%	R49, R146, R237, R248, R276, R295, R421, R422, R432, R433, R434, R435
474243	RESISTOR, 324k OHM, 1/16W, 1%	R318, R390, R380
474245	RESISTOR, 1M OHM, 1/16W, 1%	R121, R141, R159, R187, R194, R274, R279, R308, R312, R316, R320, R377
474247	RESISTOR, 10M OHM, 1/16W, 5%	R53, R410
474250	RESISTOR, 43.2k OHM, 1/16W, 1%	R169
474259	RESISTOR, 15k OHM, 1/16W, 1%	R171, R182, R284, R288
474260	RESISTOR, 121k OHM, 1/16W, 1%	R167, R372, R374
474261	RESISTOR, 7.5k OHM, 1/16W, 1%	R170, R181, R215, R226
474265	RESISTOR, 1 OHM, 1/4W, 1%	R118, R207
474284	RESISTOR, 115 OHM, 1/16W, 1%	R306
474292	RESISTOR, 13k OHM, 1/16W, 1%	R282
475042	POTENTIOMETER, 50k OHM, 10%, TOP ADJ	VR1, VR2
475043	POTENTIOMETER, 500 OHM, 10%, TOP ADJ	VR4
475046	POTENTIOMETER, 5k OHM, 10%, MULTI-TURN	VR3
481036	DIODE, ZENER, 1N5366B, 39V, 5W, 5%	D55
481046	DIODE, ZENER, MMSZ5236BT1, 7.5V, 500mW	D31
481501	DIODE, 1N4148, SIGNAL, SILICON, HIGH SPEED	D73
481546	DIODE, MMBD914L, SWITCHING	D4, D6, D29, D30, D35, D39, D41, D45, D54, D63
481547	DIODE, BAT54, HOT CARRIER SCHOTTKY	D7, D8, D47, D51, D65, D71, D72
481548	DIODE, EGL41B, RECTIFIER, SILICON	D17, D19, D20, D59, D61, D62, D67
481549	DIODE, MBRS140T3, RECTIFIER	D12, D14, D53, D58, D60, D69, D70
481552	DIODE, MBRS340T3, SCHOTTKY, 40V, 3A	D49
481554	DIODE, BAV70LT1, DUAL COMMON CATHODE, 70V	D5, D9, D16, D25, D34, D36, D43
481555	DIODE, MMBD7000LT1, DUAL SWITCHING	D1, D2, D10, D11, D13, D15, D18, D21-D24, D26-D28, D32, D33, D37, D38, D40, D42, D44, D46, D48, D50, D52, D57, D66
481557	DIODE, MBRS1100T3, SCHOTTKY, 1A, 100V	D56, D64
482551	LED, RED, WITH LENS	D3
483019	TRANSISTOR, MMBT2907ALT1, PNP, SOT-23	Q27-Q31, Q40
484061	TRANSISTOR, MMBT2222ALT1, NPN, SOT-23	Q18, Q19, Q37, Q38, Q41
484062	TRANSISTOR, MMBT2369LT1, NPN, SOT-23	Q36

PN	DESCRIPTION	REF DES
484540	VOLTAGE REGULATOR, LP2951CM, POSITIVE, ADJ	IC36
484541	VOLTAGE REGULATOR, LM317LD, 1.2V-37V OUT	IC38
484542	VOLTAGE REGULATOR, MC79L05ACD, -5V OUT, 5%	IC93
484557	VOLTAGE REGULATOR, LT1117CST-5, POS, 3 PIN	IC82
484562	IC, LT1175CS8-ADJ, MICROPOWER REGULATOR	IC89, IC90
484563	IC, LT1117CST, VOLTAGE REGULATOR, POSITIVE	IC85, IC87
484565	IC, LT1170CQ, VOLTAGE REGULATOR, 5A SW	IC86
484571	IC, LM2595S-12, VOLTAGE REGULATOR, 1A SW	IC91
485532	TRANSISTOR, 2N7002T1, N-CHAN ENHAN MODE	Q1-Q4, Q8, Q9, Q11, Q12, Q14-Q17, Q20-Q23, Q32, Q35, Q34, Q39
485540	TRANSISTOR, SI9955DY, MOSFET, DUAL, N-CHANNEL	Q24-Q26
485541	TRANSISTOR, SI9947DY, MOSFET, DUAL P-CHANNEL	Q10, Q13, Q33
485543	TRANSISTOR, SI9952DY, MOSFET, N-CH & P-CH	Q5-Q7
486037	IC, HM62B128LFP-12, 128k X 8 BITS RAM	IC4, IC6
486042	IC, AT93C66-10SC, SERIAL 4k EEPROM, 8 PIN	IC8
486049	IC, MC68332CGFC20, 20MHz, 132 PIN, PQFP	IC1
486312	IC, SCC2691AC1D24, UNIV ASYNCH RCVR/XMITTER	IC2
486314	IC, MC74HC541DW, OCTAL BUFFER/LINE DRVR	IC13, IC15, IC62
486320	IC, SN74HC14D, HEX SCHMITT-TRIGGER INV	IC7, IC11, IC61
486321	IC, SN74HC138D, 3-LINE TO 8-LINE DECODER	IC10, IC14
486322	IC, SN74HC02D, QUAD 2-IN POS NOR GATE	IC21
486323	IC, SN74HC573DW, OCTAL D-TYPE LATCH	IC17-IC20, IC66
486324	IC, DG444DY, QUAD SPST CMOS ANALOG SWITCH	IC43
486325	IC, MC14093BD, QUAD 2-IN SCHMITT TRIGGER	IC83
486326	IC, MC14013BD, DUAL D FLIP-FLOP	IC84
486332	IC, AD7703BR, 20-BIT A TO D CONVERTER	IC41, IC45
486337	IC, LT1181ACS, RS232 DUAL DRVR/RCVR, L PWR	IC69
486340	IC, TLC2543CDW, 12-BIT A TO D CONVERTER	IC12, IC46
486341	IC, DAC-8841FS, D TO A CONVERTER, 8-BIT	IC53
486348	IC, MM74HC4040M, 12-STAGE BINARY COUNTER	IC40
486785	IC, LP339M, QUAD VOLTAGE COMP, ULTRA-L PWR	IC60
486790	IC, TLE2022CD, DUAL OP AMP, HI SPEED, L PWR	IC25, IC33-IC35, IC39, IC67, IC77, IC79
486796	IC, TLC2272CD, DUAL OP AMP, RAIL TO RAIL	IC28, IC29, IC37, IC47, IC48, IC51, IC52, IC80
486805	IC, LM393M, DUAL VOLTAGE COMP, LOW POWER	IC27, IC30, IC32, IC65, IC88
486807	IC, SMP04ES, QUAD SAMPLE & HOLD, 16 PIN	IC26
486808	IC, AD680JR, 2.5 VOLTAGE REF, LOW POWER	IC70, IC81
486819	IC, AD7564BR, 12-BIT D TO A CONVERTER	IC78
486821	IC, AD822AR, FET-IN OP AMP, LOW POWER, 8 PIN	IC54, IC55, IC57, IC72, IC75, IC92, IC94
487064	IC, CNY17-III, PHOTON COUPLED ISOLATOR	IC68, IC71, IC73, IC74
487078	IC, AD712JR, DUAL BIFET OP AMPLIFIER	IC42, IC44
487094	IC, RTC-62423, REAL TIME CLOCK W QTZ XTAL	IC16
487100	IC, TC1426COA, INV DUAL MOSFET DRVR, 1.2A	IC31
487103	IC, TC4405COA, OPEN-DRN FET DRVR, NON-INV	IC24
487104	IC, TC4404COA, OPEN-DRN FET DRVR, INVERTING	IC23
487108	IC, TL7757CD, VOLTAGE SUPERVISOR, 8 PIN	IC9
487114	IC, MC34119D, AUDIO AMP, LOW POWER, 8 PIN	IC76
487115	IC, AD620BR, INSTR AMP, LOW POWER, 8 PIN	IC49, IC56, IC58
513010	SWITCH, SLIDE, SPDT, 4 SWITCHES, .050 SPACING	S1
515082	FUSE W FUSEHOLDER, 1/2A, 125V, V FAST-ACT	F3, F5
515088	FUSE W FUSEHOLDER, 1/16A, 125V, V FAST-ACT	F1
515089	FUSE W FUSEHOLDER, 1/8A, 125V, V FAST-ACT	F2, F4

☆ DENOTES THRU HOLE COMPONENTS

DRAWING TABULATION

DWG NO.	TITLE	NEXT ASSY
D2731-17	MAIN BOARD SUBASSY, MODEL 8100	D2731-01
D2731-01	MAIN BOARD ASSY, MODEL 8100	D6758-01

REV	R NO.	DATE
03	N501	4Aug97
02	N475	28May97
01	Prod	Release

DO NOT SCALE
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES (mm)
BREAK ALL SHARP EDGES
TOLERANCES
DEC ± ~ (mm) (± ~)
FRAC ± ~ (mm) (± ~)
HOLES + .007 - .003 (mm) (± ~)
ANG ± ~

MATERIAL ~

FINISH ~

TITLE: MAIN BOARD ASSY, MODEL 8100 - COSMO+

NOVAMETRIX MEDICAL SYSTEMS INC. WALLINGFORD, CT U.S.A. 06492

DRAWN	CHECKED
BL 11Oct98	MRL 15Apr97
MFG ENGR MJC 5/13/97	APPROVED RHD 28May97

USED ON: SEE TAB

SIZE	DRAWING NO.	CODE	REV
D	2731	17 01	03

SCALE: NONE SHEET 3 OF 3

D[0:15]

A[1:17]

MVDD L1 61R30T VDD

IC1 MC68332

VSTBY VDD VSS

C2 10u Tant 25V C3 0.01u C4 0.01u C5 0.01u C6 0.01u

T2CLK 128 T2CLK

CO2AZ TP0
CO2PWENB TP1
SRCDRV0 TP2
CS*/H TP3
SRCDRV1 TP4
SS*/H TP5
CASEPWM TP6
DETPWM TP7
ASAMP* TP8
RDLED* TP9
RSAMP* TP10
IRLED* TP11
ISAMP* TP12
TOUT1 TP13
TOUT2 TP14
TOUT3 TP15

L4 L6 F0818-1SR

LED MODCLK/PF0
SYSUP IRQ1*/PF1
CASEOT IRQ2*/PF2
DETOT IRQ3*/PF3
EXTDCIN IRQ4*/PF4
UARTIRQ* IRQ5*/PF5
PWRDWN* IRQ6*/PF6
NMI* IRQ7*/PF7

BERR* 70 BERR*
HALT* 69 HALT*
SRST* 68 RESET*

L9 F0818-1SR

SSDI MISO
SSDO MOSI
SSCLK SCK
PCS0 PCS0*/SS*
PCS1 PCS1*
PCS2 PCS2*
PCS3 PCS3*
ASTxD TxD
RxD

ASRxD SYSCLKO R297 100 CLKOUT

C182 22p L11 51R00P VDD C13 0.01u VDDSYN

XFC

C14 22p R49 249K Y2 32.768KHz C16 22p R53 10M EXTAL XTAL

L2 F0818-1SR

D0 D1 D2 D3 D4 D5 D6 D7 D8 D9 D10 D11 D12 D13 D14 D15

L3 L5

A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 A12 A13 A14 A15 A16 A17 A18

C282 100p

CSBOOT* BOOTCS*
BR*/CS0* UBRAMWR*
BG/CS1* LBRAMWR*
BACK/CS2* RAMRD*
FC0/CS3* ROMWR*
FC1/CS4* IORW*
FC2/CS5* ROMWREN
UARTCS*

L8

A19/CS6* PROFILE*
A20/CS7* DISPCS*
A21/CS8*
A22/CS9* FLOWIO*
A23/CS10* RTCCS*

SIZ1/PE7 JP1*
SIZ0/PE6 JP0*
AS*/PE5
DS*/PE4
RMC*/PE3 CNFG1*
AVC*/PE2 CNFG0*
DS1*/PE1 DS1*
DS0*/PE0 TST*

C281 100p L12 AS* L13 DS* 51R00P

R/W* WR*

IPIPE* IPIPE*
IFETCH* IFETCH*
BKPT* BKPT*
TSTME* TSTME*
FREEZE FREEZE

L14 F0418-1SR

IC7A 74HC14 R/W* RD*

ROMWR* ROMWREN VDD R1 100K Q1 2N7002

IC3 29C010/020

A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 A12 A13 A14 A15 A16 A17

D0 D1 D2 D3 D4 D5 D6 D7

NC/A17 A18 VDD VCC NC/VPP C10 0.01u

ROMOE* CE OE WE GND

IC5 29C010/020

A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 A12 A13 A14 A15 A16 A17

D8 D9 D10 D11 D12 D13 D14 D15

NC/A17 A18 VDD VCC NC/VPP C11 0.01u

ROMOE* CE OE WE GND

IC9 TL7757 VDD RST* GND C17 0.01u

IC7B 74HC14 RESET SRST*

SRST* VBACK R2 100K Q2 2N7002

IC4 628128

A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 A12 A13 A14 A15 A16 A17

D0 D1 D2 D3 D4 D5 D6 D7

VBACK VCC C9 0.01u GND

SRST* SRAMOE* LBRAMWR* CS1 CS2 OE WE

IC6 628128

A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 A12 A13 A14 A15 A16 A17

D8 D9 D10 D11 D12 D13 D14 D15

VBACK VCC C12 0.01u GND

SRST* SRAMOE* UBRAMWR* CS1 CS2 OE WE

IC8 93C66 OBEECS SSCLK SSDO SSDI CS SK DI DO VDD DC ORG GND VDD C15 0.01u

J402 Aux Serial, DNP UMPI URxD UTxD VDD

IC2 SCC2691

UARTIRQ* RESET RD* WR* UARTCS* A1 A2 A3 D8 D9 D10 D11 D12 D13 D14 D15

INT RESET RDN WRN CEN A0 A1 A2 D0 D1 D2 D3 D4 D5 D6 D7 VDD RxD TxD MPO MPI X1/CLK X2 GND

C1 0.01u VDD D1 D2 D7000 URxD UTxD UMPI

Y1 3.686MHz C7 22p C8 22p

SRST* BKPT* R3 4.99K R5 4.99K

TST* CNFG0* CNFG1* JP0* JP1* R8 R10 R12 R14 R16 100K

R20 DNP R21 10

MVDD

D0 D1 D2 D3 D4 D5 D6 D7 D10 D11 R29 R31 R33 R35 R37 R39 R41 R43 R45 R47 10K

D8 D9 CO2PWENB SYSUP ROMWREN CASEPWM DETPWM PWRDWN* R51 R54 R56 R58 R60 R62 R64 R66 10K

RESET R68 1K

T2CLK CO2AZ CS*/H SS*/H ASAMP* RSAMP* RDLED* ISAMP* ISAMP* TOUT1 TOUT2 TOUT3 LED CASEOT DETOT UARTIRQ* NMI* SSDI SSDO SSCLK PCS0 PCS1 PCS2 PCS3 ASRxD DS1* AS* DS* BERR* HALT* TSTME* ROMOE* SRAMOE* URxD UMPI R4 R6 R7 R9 R11 R13 R15 R17 R18 R19 R22 R23 R24 R25 R26 R27 R28 R30 R32 R34 R36 R38 R40 R42 R44 R46 R48 R50 R52 R55 R57 R59 R61 R63 R65 R67 10K 100K

CO2INH

S1 SW-4 TST* CNFG0* CNFG1* JP0*

D3 BR1101 R69 499 VDD Q3 2N7002 LED R70 100

IC7F 74HC14

J401 Boot Select, DNP RAMRD* SRAMOE* BOOTCS* ROMOE*

J400 Background Mode, DNP DS* BERR* BKPT* FREEZE SRST* IFETCH* IPIPE* MVDD

			MAIN BOARD - MODEL 8100			Novametrix Medical Systems, Inc. 5 Technology Drive Wallingford, CT USA 06492	
			Drawn: RHD 24Oct95	Checked: MRL			
03	N501	11Aug97	Mfg MJC	Approved: RHD	Size B	Document Number 2731	Code 03 Rev 03
02	N475	4June97	Eng: 30May97	30May97			
01	Prod	Release	File: 27310302				Sheet 1 of 10
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A[1..17]
D[0..15]

R71 R72 R73 R74 R75 R76 10K
R77 R78 10K
VDD
CO2XDISC
CO2ZERO*
CO2SPAN*
PWRSW
D4
D914
R84 R85 R86 R87 10K
R88 R89 R90 R91 10K

J403 Keypanel
S13 S11 S12 S1 S2 S3 S4 S5 S6 S7 S8 S9 S10
EXTONLED
2MINLED
AOFFLED
SPARELED
BATTLED

R79 100 ADJUP
R80 100 ADJDWN
R81 100 NEXTITEM
R82 100 POWER
R83 100 CONTRAST

IC13 74HC541
IORW*
RD*
C18 0.01u

R92 100 AUDIOSW
R93 100 ALERTSW
R94 100 EVNTERZ
R95 100 CO2PLETH
R96 100 FLOWPRES
R97 100 TREND
R98 100 DATA
R99 100 SETUP

IC15 74HC541
C24 0.01u
LINEST

IC17 74HC573
IC19 74HC573
D0 D1 D2 D3 D4 D5 D6 D7
C25 0.01u
RESET

J405 Alerts
ALERTS
Q4 2N7002
R102 100
BACKLITE
SAMPLE

SPO2CAL
SPO2SCI
SPO2LPON
INSIG*
SIGND*
OCDRV3
OCDRV4
OCDRV5
D8 D9 D10 D11 D12 D13 D14 D15
C27 0.01u

J406 Display
VDISP
WR*
RD*
DISPCS*
SRST*
C28 0.01u
A1

IC21A 74HC02
IORW*
WR*

SSDI
CO2DATA
CO2REF
CO2ISRC
CO2CASE
CO2DET
SPO2FEDC
SPO2RDLED
SPO2IRLED
ABPRESS
VSPUMP
VBATTADC

IC12 TLC2543
DOUT
CVREF
REF+
REF-
ADCCS1*
SSDO
SSCLK
CS
ADDIN
IOCLK
EOC
VCC
GND
CVDD
C19 0.01u
C21 10u Tant 25V
C20 0.01u
C22 10u Tant 25V

IC16 RTC62423
A1 A2 A3 A4
D8 D9 D10 D11
SRST*
RTCCS*
Q39 2N7002
R420 100K
RD*
WR*
VBACK
C23 0.01u
R100 100K
R101 100K
SRST*
STD.P
ALE
CS1
XT
GND

IC18 74HC573
IC20 74HC573
D0 D1 D2 D3 D4 D5 D6 D7
D8 D9 D10 D11 D12 D13 D14 D15
C26 0.01u
C29 0.01u
RESET
PD0 PD1 PD2 PD3 PD4 PD5 PD6 PD7 PD8 PD9 PD10 PD11 PD12 PD13 PD14 PD15
J404 Profile, DNP

IC7E 74HC14
PROFILE*
VBKLITE
IC22 E1097
VIN VO1 VC VO2
Isolated
J407 CCD Backlight
Q5A Si9952
BACKLITE
R103 10 1/2W
C30 10u Tant 35V

IC10 74HC138
PCS0 PCS1 PCS2 PCS3
VDD
A B C G1 G2A G2B
Y0 Y1 Y2 Y3 Y4 Y5 Y6 Y7
ADCCS1*
DACCS1*
IC11F
IC11B
CALEECS
OBEECS
SPO2RDADC*
SPO2IRADC*
IC11E
DACLD1*

IC14 74HC138
ADCCS2*
IC7C 74HC14
DACLD2

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01	Prod.	Release	File: 27310302		Code 03
Rev.	"R" No.	By Date	Date Thursday, September 11, 1997		Rev 03

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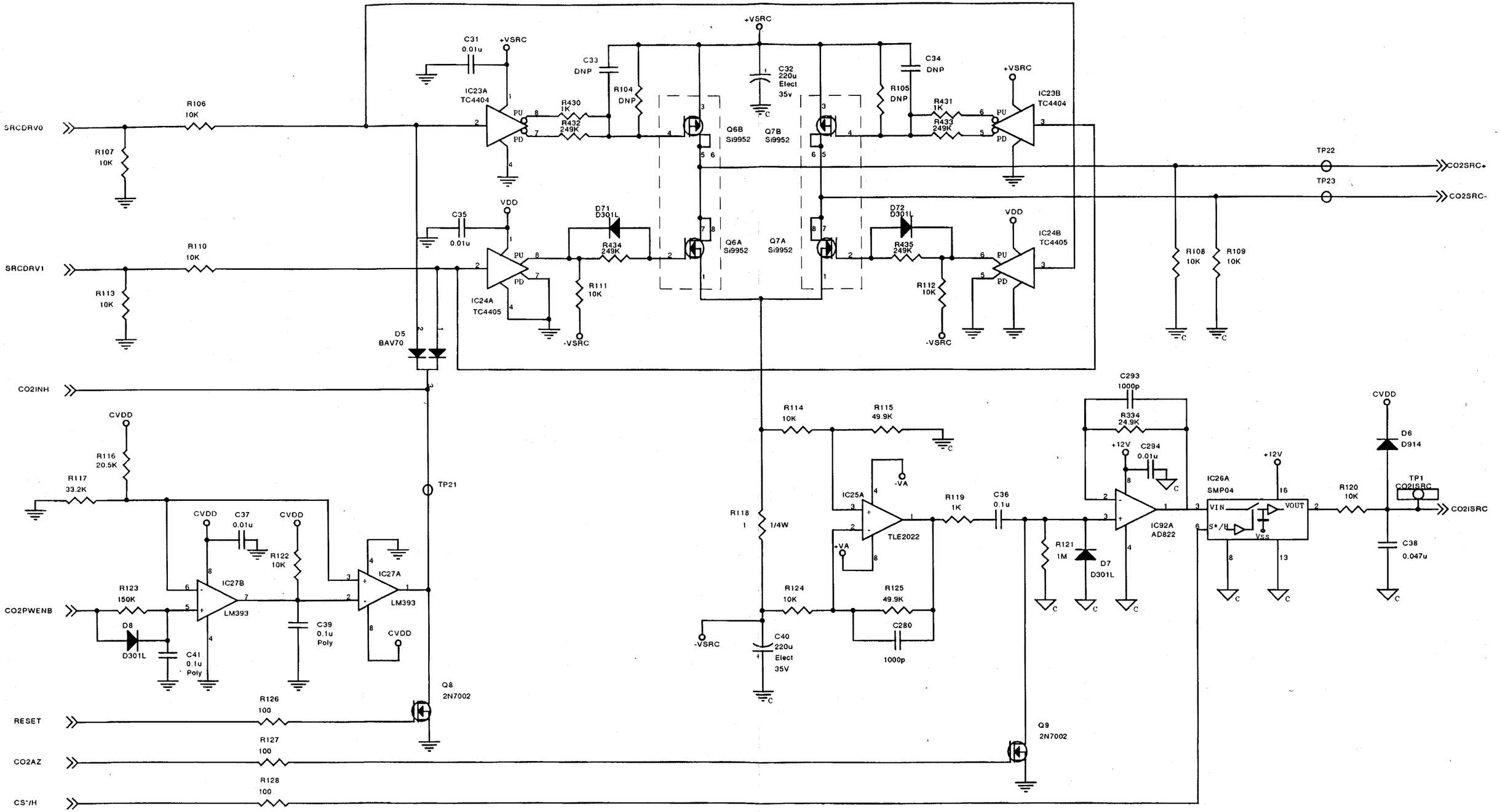
Sheet 2 of 10



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02	N475	4June97					
01	Prod	Release	File: 27310302				Sheet 3 of 10
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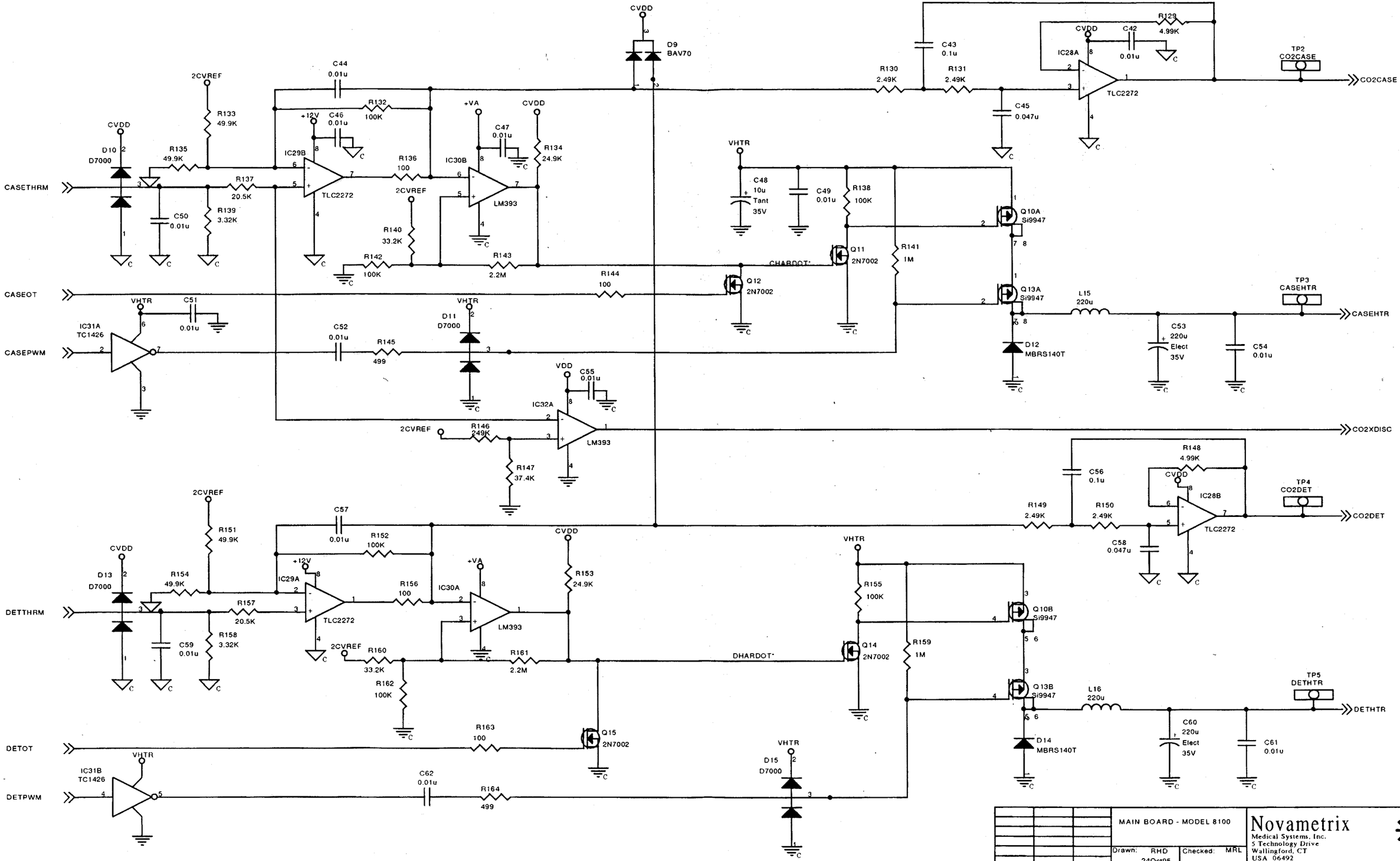

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02	N475	4June97	File: 27310302		Sheet 4 of 10
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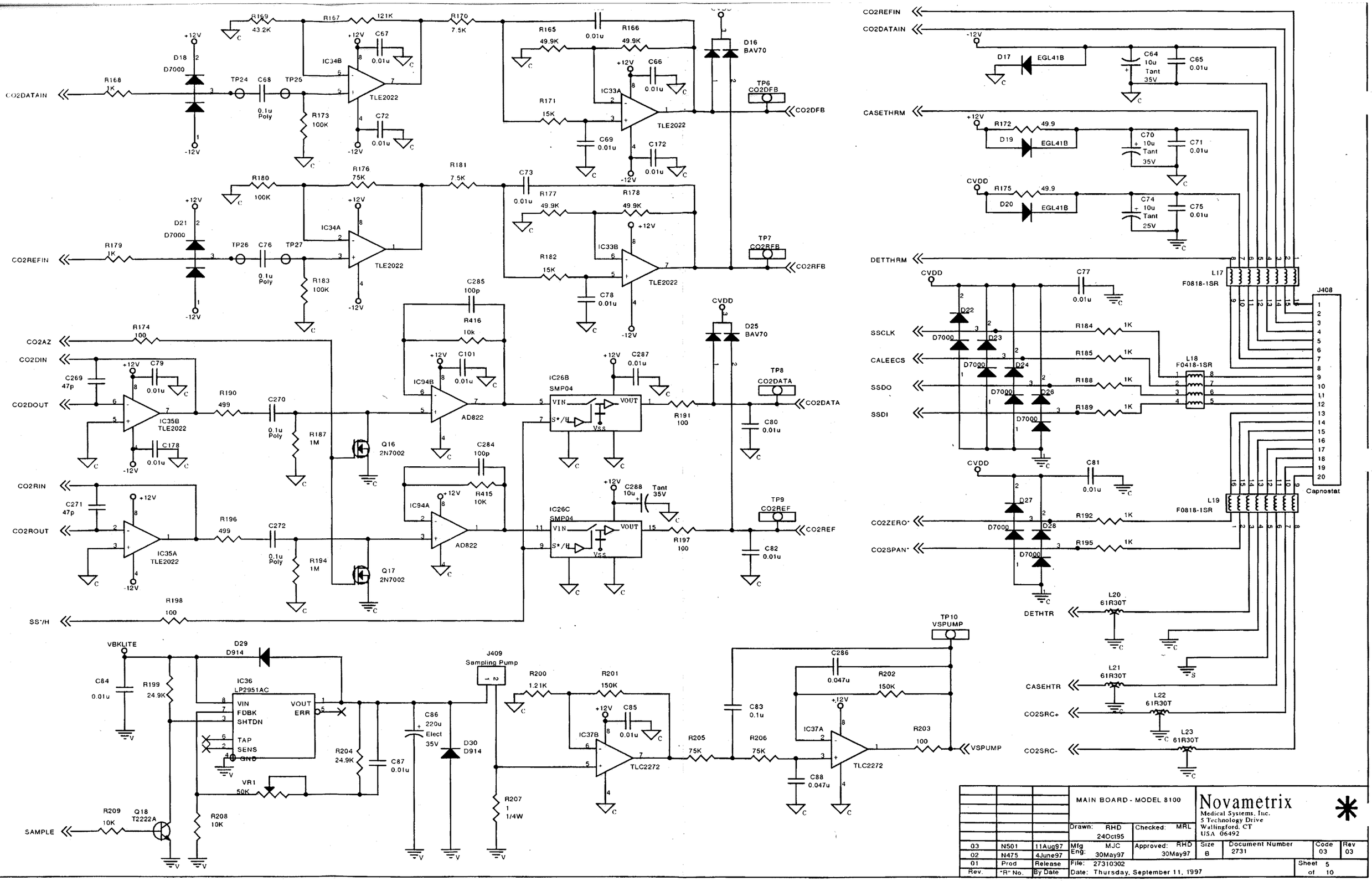
Rev.	"R" No	By Date			



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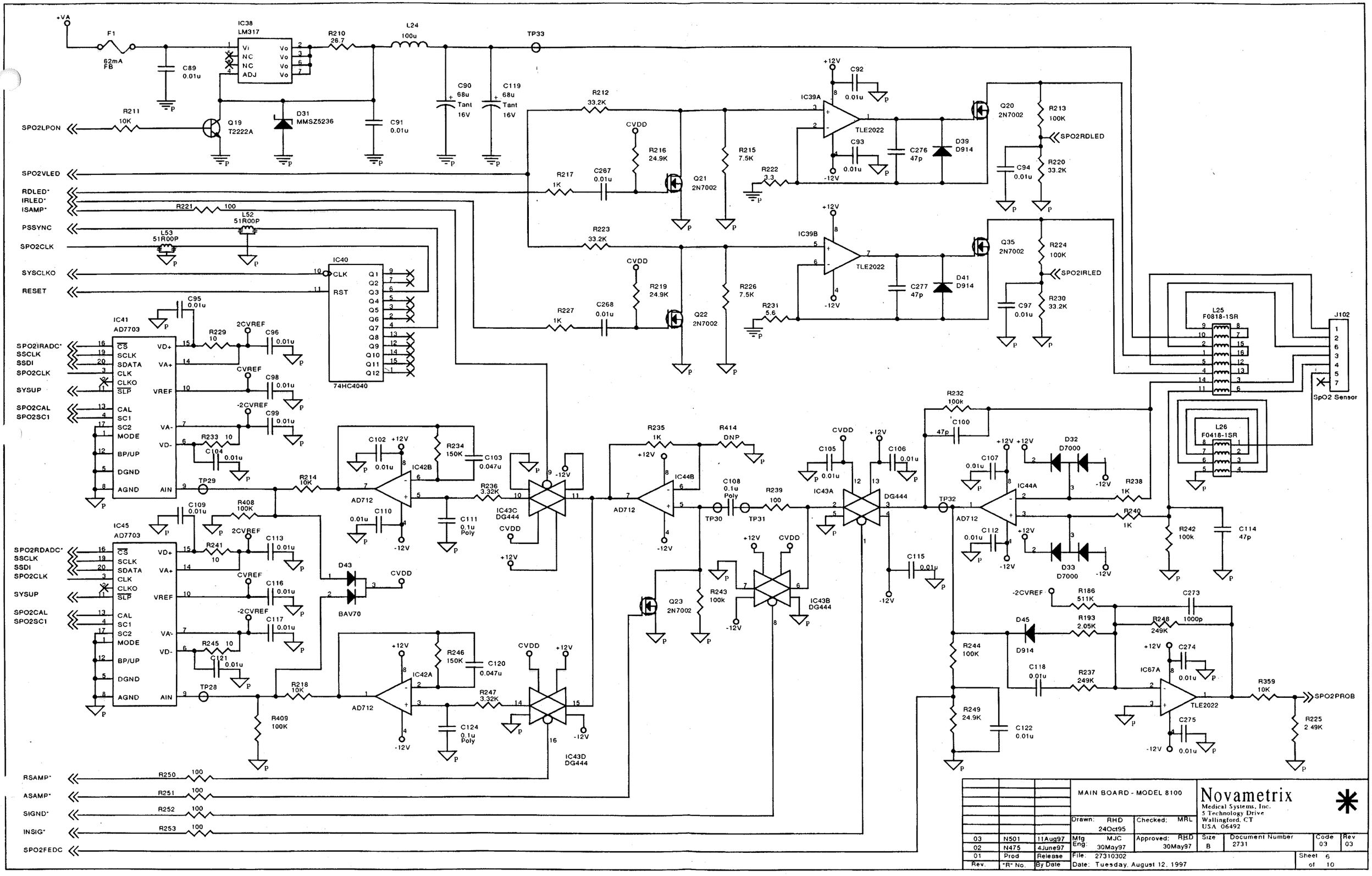

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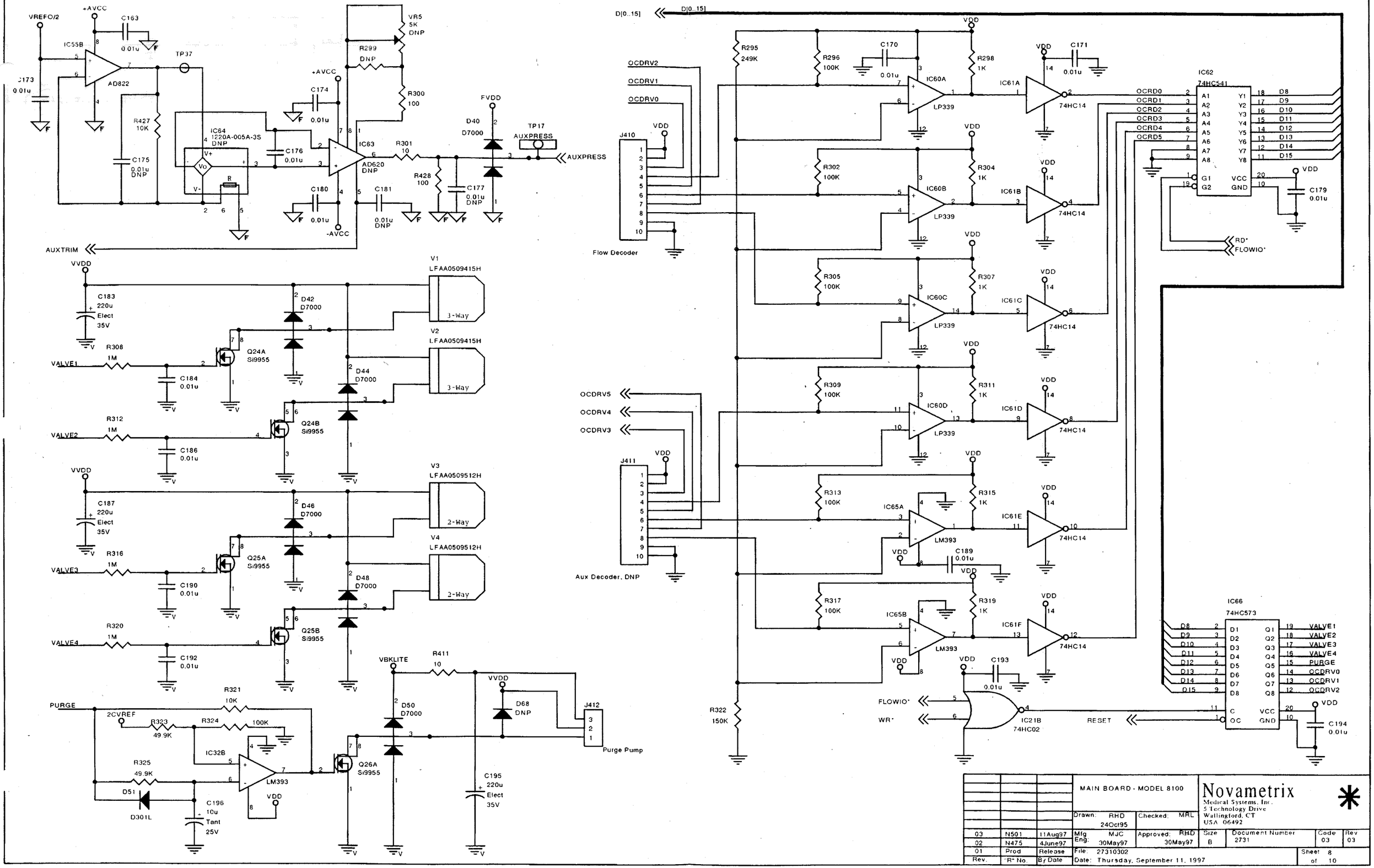

MAIN BOARD - MODEL 8100

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ASRxD
UTxD
URxD

IC70 AD680: TP, TP, VO, NC / TP, VIN, TEMP, GND; +VA; C200 0.01u

TP38 R331 10

C203 0.01u; C204 10u Tant 25V

VREFO

R338 10K R339 10K TP53 2CVREF

C205 0.01u C206 0.01u +12V

IC72A AD822 R342 10 C207 4.7u Tant 10V

TP39 CVREF

R344 10K C208 0.01u +12V

IC72B AD822 R346 10 C209 4.7u Tant 10V

R348 10K R349 10K TP54 2VREFO

C210 0.01u C211 0.01u +AVCC

IC75A AD822 R351 10 C212 4.7u Tant 10V

TP40 VREFO/2

R353 4.99K C213 0.01u +AVCC

IC75B AD822 R357 10

R355 10K R358 10K

Isolation Barrier

VDD IC68 CNY17-3 R328 100K R329 499 Q27 T2907A R429 1K

IVDD R326 100K

IVDD IC71 CNY17-3 R337 100K R340 499 Q28 T2907A R341 1K

IVDD R343 100K

VDD IC73 CNY17-3 R345 100K R347 499 Q29 T2907A R350 1K

VDD IC74 CNY17-3 R352 100K R354 499 Q30 T2907A R356 1K

IC69 LT1181: C1+, C1-, C2+, C2-, TR1IN, RC1OUT, TR2IN, RC2OUT / VCC, V+, GND, V-, RC1IN, TR1OUT, TR2OUT, RC2IN

C199 0.1u C201 0.1u

IVDD C197 0.01u C198 0.1u C202 0.1u

IRAW F2 125mA FB

L27 61R30T L28 61R30T L29 61R30T

R327 1K FB R330 1K

L30 F0418-1SR

R332 1K R333 1K R335 1K R336 1K

R407 1K L54 51R00P

J100 Serial Comm

IVDD F3 500mA FB L31 61R30T

E1 GRN/YEL to REAR PANEL

IRAW F4 125mA FB L32 61R30T

J101 Neonatal Heater, DNP

CVDD

IC78 AD7564: VDD, DGND, SDOUT, CLR, LDAC, FSIN, SDIN, CLKIN, A1, A0, RFBA, RFBB, VREFC, VREFD, AGND, VREFA, IOUT1A, IOUT2A, VREFB, IOUT1B, IOUT2B, RFBC, IOUT1C, IOUT2C, RFBD, IOUT1D, IOUT2D

C219 0.01u C215 10u Tant 25V

SRST* DACLD1* DACCS1* SSDO SSCLK

CO2DFB CO2RFB -2CVREF C225 0.01u

CO2DIN CO2DOUT CO2RIN CO2ROUT

C252 100p C254 100p +12V -12V

IC67B IC77A TLE2022

DTOUT1 DTOUT2 DTOUT3

R367 10K R368 24.9K R369 49.9K

SPO2VLED

CVDD R361 24.9K R362 33.2K R363 10K TP41 Q31 T2907A VDISP R365 100

R366 33.2K IC77B TLE2022 C216 0.01u C224 0.01u

IC79A TLE2022 R370 10K C279 0.01u C218 0.01u R364 1K C226 0.01u

C214 0.1u L33 10u

C217 0.01u R360 100 C220 0.1u

R412 10K R413 10K

IC76 MC34119: VIN, FC1, FC2, CD, VOUT1, VOUT2, VCC, GND

C221 10u Tant 25V C223 0.01u C222 0.01u

VDD J413 Speaker

SYSUP IC7D 74HC14

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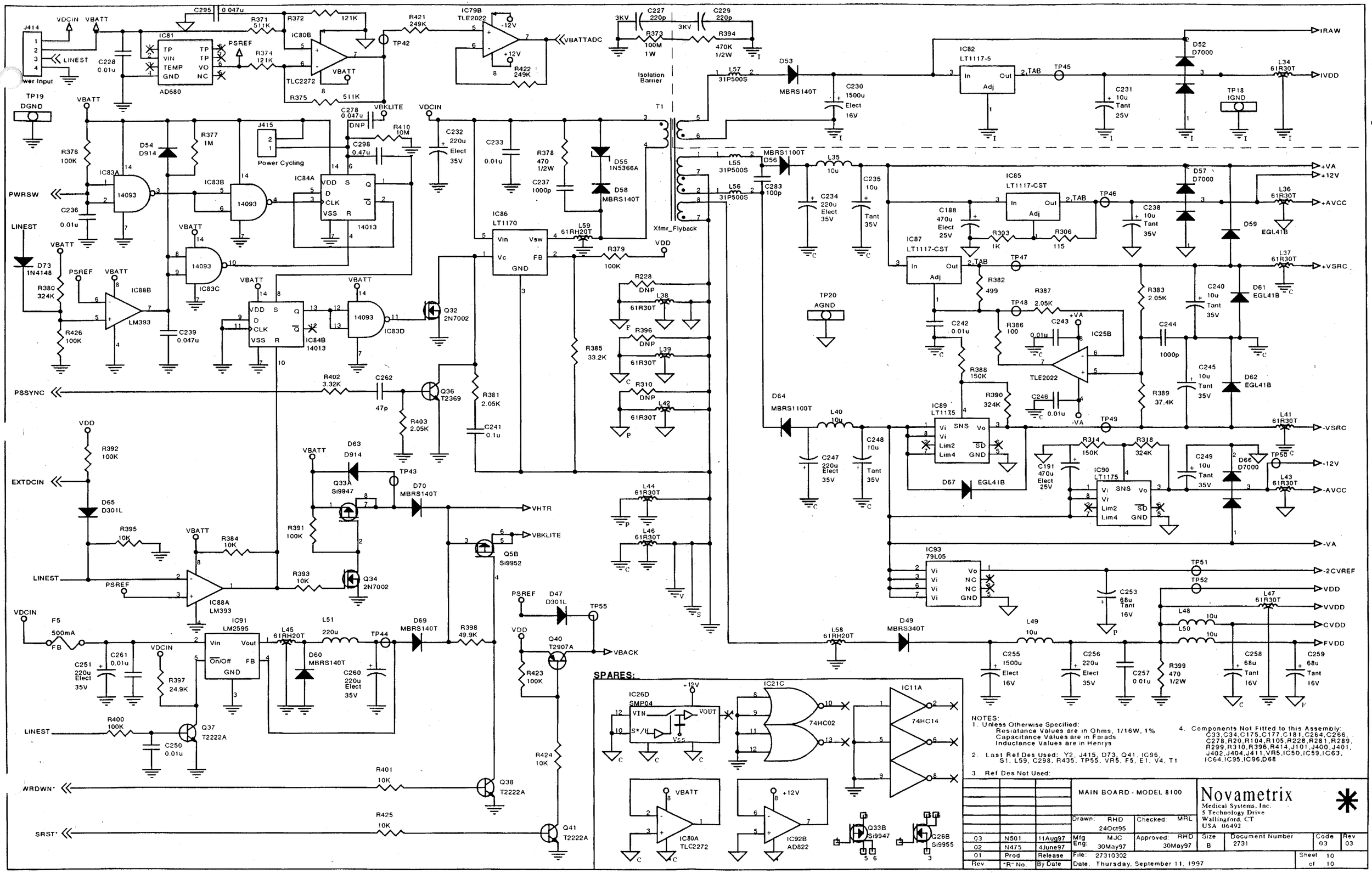

NOTES:
1. Unless Otherwise Specified:
   Resistance Values are in Ohms, 1/16W, 1%
   Capacitance Values are in Farads
   Inductance Values are in Henrys
2. Last Ref Des Used: Y2, J415, D73, Q41, IC96, S1, L59, C298, R435, TP55, VR5, F5, E1, V4, T1
3. Ref Des Not Used:
4. Components Not Fitted to this Assembly: C33,C34,C175,C177,C181,C264,C266, C278,R20,R104,R105,R228,R281,R289, R299,R310,R396,R414,J101,J400,J401, J402,J404,J411,VR5,IC50,IC59,IC63, IC64,IC95,IC96,D68

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01	Prod	Release	File: 27310302				Sheet 10 of 10
Rev	"R" No.	By Date	Date: Thursday, September 11, 1997				

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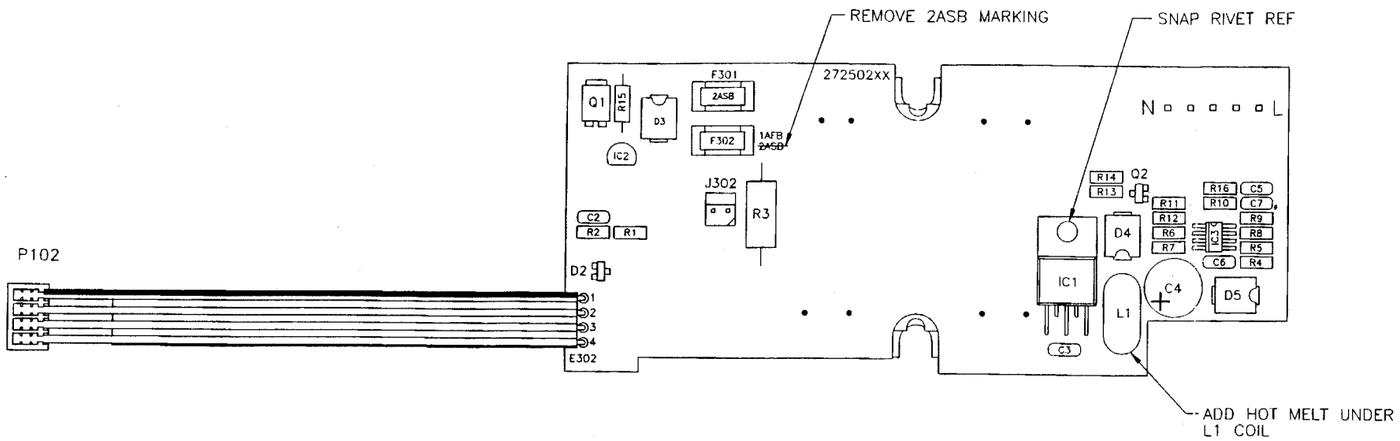

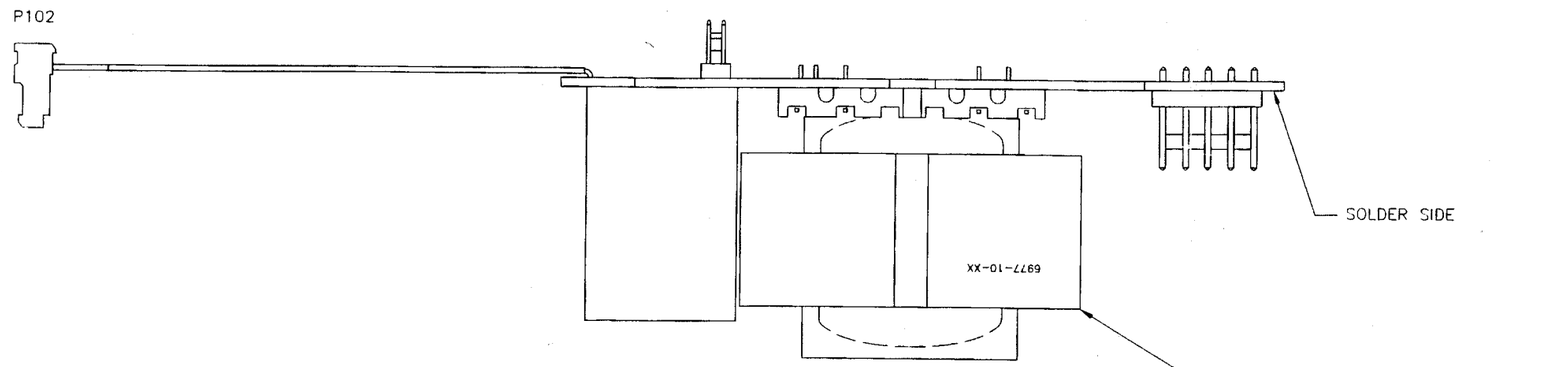

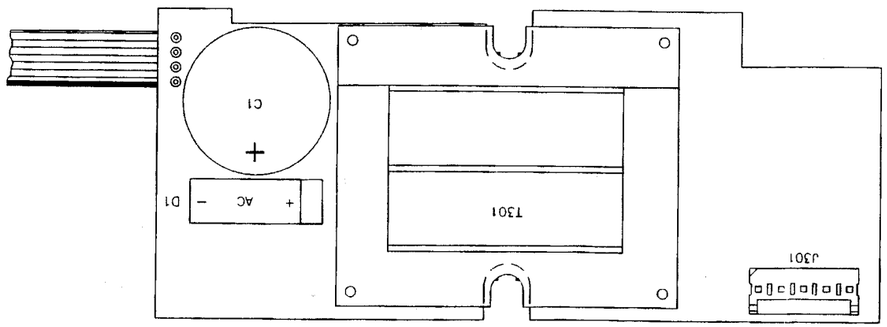

D2748-17 SUBASSEMBLY		
PN	DESCRIPTION	REF DES
2725-02	FAB, POWER SUPPLY BOARD, 2ND GENERATION	~
☆D6977-10	TRANSFORMER, MAINS, POWER SUPPLY BOARD	T301
☆ 152029	CAPACITOR, 220uF 20%, 35V, ELECTROLYTIC	C4
☆ 152081	CAPACITOR, 6800uF, 35V, 20%, ELECTROLYTIC	C1
154072	CAPACITOR, .1uF, 50V, 10%, X7R, CERAMIC CHIP	C2, C3, C5-C7
☆ 180014	INDUCTOR, 25uH, .25 SPACING	L1
☆ 211213	CONNECTOR, 2 PIN, POST HEADER	J302
☆ 211505	CONNECTOR, 5 PIN, SQUARE POST HEADER	J301
280114	SNAP RIVET, .118-.158 THK PANEL	FOR IC1
☆470026	RESISTOR, 150 OHM, 1/4W, 10%	R15
474145	RESISTOR, 215 OHM, 1/8W, 1%	R11
474151	RESISTOR, 37.4k OHM, 1/8W, 1%	R6
474162	RESISTOR, 61.9k OHM, 1/8W, 1%	R13
474165	RESISTOR, 10k OHM, 1/8W, 1%	R10
474166	RESISTOR, 100k OHM, 1/8W, 1%	R5, R7, R9
474167	RESISTOR, 2.2M OHM, 1/8W, 1%	R2
☆474181	RESISTOR, 4.3 OHM, 1W, 5%	R3
474211	RESISTOR, 49.9k OHM, 1/8W, 1%	R4
474214	RESISTOR, 332k OHM, 1/8W, 1%	R1, R14
474215	RESISTOR, 2.21k OHM, 1/8W, 1%	R16
474216	RESISTOR, 4.99k OHM, 1/8W, 1%	R12
474218	RESISTOR, 47.5k OHM, 1/8W, 1%	R8
481044	DIODE, ZENER, BZX84C12LT1, 12V	D2
☆ 481530	DIODE, KBU4D, 4 AMP, BRIDGE RECTIFIER	D1
481552	DIODE, MBRS340T3, SCHOTTKY, 40V, 3A	D3, D4, D5
☆ 484529	VOLTAGE REGULATOR, LM78L05ACZ, 5V, 100MA	IC2
☆ 484559	VOLTAGE REGULATOR, LT1076CT FLOW 30, 2A	IC1
485532	TRANSISTOR, 2N7002T1, N-CHANNEL, ENHAN	Q2
☆ 485535	TRANSISTOR, IRFD9020, P-CHANNEL, MOSFET	Q1
486805	IC, LM393M, DUAL VOLTAGE COMP, L PWR	IC3
515083	FUSE W FUSEHOLDER, 1A, 125V, V FAST-ACTING	F302
515085	FUSE WITH FUSEHOLDER, 2A, 125V, SLO-BLO	F301
600034	RIBBON CABLE ASSY, 4 PIN, 4 INCHES LONG	P102

D2748-01 ASSEMBLY		
PN	DESCRIPTION	REF DES
D2748-03	SCHEMATIC, POWER SUPPLY BOARD, JAPAN	~
A2748-04	TEST PROCEDURE, POWER SUPPLY BOARD, JAPAN	~
D2748-17	POWER SUPPLY BOARD SUBASSY, JAPAN	~

NOTES:
1. D2748-17 SPECIFICATIONS: ☆ DENOTES THRU HOLE COMPONENTS.
2. D2748-01 SPECIFICATIONS: FOR TEST PROCEDURE SEE A2748-04.

DRAWING TABULATION		
DWG NO.	TITLE	NEXT ASSY
D2748-17	POWER SUPPLY BOARD SUBASSY, JAPAN	D2748-01
D2748-01	POWER SUPPLY BOARD ASSY, JAPAN	D6496-01

DO NOT SCALE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES (mm)
BREAK ALL SHARP EDGES
TOLERANCES
DEC ± ~ (mm) ± ~
FRAC ± ~ (mm) ± ~
HOLES +.007 -.003 (mm) (+.18 -.08)
ANG ± ~
MATERIAL ——
FINISH ——

TITLE: POWER SUPPLY BOARD ASSEMBLY, JAPAN, MODEL 8100

DRAWN	CHECKED
BL 19Aug97	MRL 21Aug97
MFG ENGR	APPROVED
BN 21Aug97	RHD 21Aug97

USED ON: SEE TABULATION

NOVAMETRIX MEDICAL SYSTEMS INC.
WALLINGFORD, CT U.S.A. 06492

SIZE	DRAWING NO.	CODE	REV
D	2748	17 01	00

SCALE: 2/1 SHEET 1 OF 1

REV	R NO.	DATE

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Isolation Barrier

△ J301

T301

D1 KBU4G

Elect 35V C1 6800uf

D2 BZX84 C12LT1

Q1 IRFD9020

VCH

C3 1uf

△ NOTE 3

△ NOTE: IC1 is thermally coupled to the circuit board.

IC1 LT1076 (VIN, VSW, GND, VFB, VC)

L1 25uH

D5 MBRS340T3

D4 MBRS340T3

Elec 35 C4 220uf

FB

C2 .1uf

C7 .1uf

R16 2.21k

C5 .1uf

IC3 LM393M

R4 49.9k

R3 4.3 1W 5%

R6 37.4k

R5 100k

R7 100k

R1 332k

R2 2.2M

R13 61.9k

R14 332k

R12 4.99k

Q2 2N7002T1

R11 215

R10 10k

C6 .1uf

R8 47.5K

R9 100k

△ E301

△ P102

VIN

F301 125V 2A Slo-Blo

D3 MBRS340T3

F302 125V 2A V Fast-Act

E1

LINEST

DGND

IC2 78L05 (OUT, IN, GND)

R15 150 10% 1/4W

△ J302

Power Out/VBAT+

DGND/VBAT-

△ NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   RESISTANCE VALUES ARE IN OHMS, 1/8W, 1%
2. LAST REF DES USED: C7, D5, E301, F302, IC3, J302, L1, Q2, R16.
3. CONNECT DGND AND AGND ONLY AT IC1-3.

REV.	"R" NO.	BY	DATE

DO NOT SCALE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES (mm) BREAK ALL SHARP EDGES

MATERIAL:

FINISH:

FILE: 27480300
DATE: 21-Aug-97
TIME: 11:28:18

SCHEMATIC, POWER SUPPLY BOARD, JAPAN, MODEL 8100

DRAWN B.Lancaster 19Aug97

CHECKED MR 21Aug97

MFG. ENGR BW 21 Aug 97

APPROVED RHO 21aug97

USED ON D2748-01

NOVAMETRIX
Medical Systems, Inc.
Wallingford, CT USA 06492

SIZE	DWG NO.	CODE	REV.
D	2748	03	00

SCALE: NONE

SHEET 1 OF 1

SSDI

FLOW1
FLOW10
FLOW100
FLOW1000
AWPRESS
AUXPRESS
SPO2PROB

IC46 TLC2543
A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 REF+ REF- CS ADDIN IOCLK EOC VCC GND DOUT

VREFO
ADCCS2*
SSDO
SSCLK
FVDD
C138 0.01u
C141 10u Tant 25V
C139 0.01u
C140 10u Tant 25V

IC54A AD822
IC54B AD822
+AVCC
C290 0.01u
C133 0.01u
C123 0.01u
R404 1K
TP36
C263 0.01u
C264 10u Tant 16V
VREFO/2

IC50 SPL004D
Vs Vo Gnd
2VREFO
C296 0.047u
IC95 DXL01D
R405 10
R406 1.21K
C265 0.01u
C266 10u Tant 16V

IC49 AD620
C137 0.01u
C143 0.01u
C185 1000p
-AVCC
TP35
R266 75K
D35 D914

VR2 50K
R259 24.9K
R260 2.49K
C134 0.01u

R255 49.9K
C255 0.1u
C127 0.01u
IC47A TLC2272
C130 0.01u

C135 0.1u
C132 0.047u
R261 150K
IC47B TLC2272
R267 75K
R264 100
C142 0.047u

R254 100K
C126 0.01u
IC48A TLC2272
C128 0.01u
R256 100
D34 BAV70
TP11 FLOW1
C129 0.01u

R257 10K
R258 100K
C131 0.01u
IC48B TLC2272
R263 100K
R265 10K
R262 100
TP12 FLOW10
C136 0.01u
R268 1K
R269

R271 100K
R272 1K
R273
C144 0.01u
IC51A TLC2272
C145 0.01u
R270 100
D36 BAV70
TP13 FLOW100
C149 0.01u

R274 1M
C152 1000p
IC51B TLC2272
R279 1M
R280 1K
R278 100
TP14 FLOW1000
C154 0.01u

C146 10u Tant 25V
C147 0.01u
IC52A TLC2272
C150 0.01u
C289 0.01u
R417 10K
R275 499
R276 249K
R277 1.21K
IC52B TLC2272
R418 10K
C148 0.01u
C153 0.01u

VREFO/2
C151 0.01u
IC53 DAC8841
VINA VINB VINC VIND VINE VINF VING VINH SDI LD CLK PR VDD VOUTA VOUTB VOUTC VOUTD VOUTE VOUTF VOUTG VOUTH SDO VREFL GND
AUXTRIM
DTOUT1
DTOUT2
DTOUT3
TOUT1
TOUT2
TOUT3
SSDO
DACLD2
SSCLK
SRST*

VR3 5K
R281 4.99K
R282 13K
VR4 500
R289 DNP
R291 499
R284 15K
R288 15K
C155 0.01u
C157 0.01u
C161 0.01u
C160 0.01u
IC56 AD620
IC58 AD620
C162 0.01u
C167 0.01u
C169 0.01u
IC59 1220A-015A-3S
V+ Vo V- R
IC96 CFC15A
Vs Vo Gnd
2VREFO
C297 0.047u
TP34
IC57B AD822
C158 0.01u
C165 0.01u
C166 0.01u

C156 0.1u
R283 150K
C292 0.047u
IC55A AD822
R285 100
R286 75K
R287 75K
C159 0.047u
D37 D7000
TP15 AWPRESS
AWPRESS

C164 0.1u
R290 150K
C291 0.047u
IC57A AD822
R293 75K
R294 75K
C168 0.047u
R292 100
D38 D7000
TP16 ABPRESS
ABPRESS

			MAIN BOARD - MODEL 8100				
			Drawn: RHD 24Oct95	Checked: MRL			
03	N501	11Aug97	Mfg Eng: MJC 30May97	Approved: RHD 30May97	Size B	Document Number 2731	Code 03 Rev 03
02	N475	4June97	File: 27310302				
01	Prod	Release	Date: Thursday, September 11, 1997				Sheet 7 of 10
Rev.	"R" No.	By Date					

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